Teaching Statement

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Sharing knowledge is a primary motivation for me to pursue an academic career. During my PhD at ETH Zurich, I thoroughly enjoyed the mentoring and teaching opportunities I had. I have mentored fifteen master students doing their semester or master theses, three of which have resulted in top-tier publications. I have also worked as a teaching assistant for one undergrad and one graduate course at ETH for a total of seven semesters. These experiences have fascinated me and motivated me to continuously improve my teaching and mentoring practices to meet my students' needs. As a young faculty member, I look forward to the responsibility and privilege of providing students the necessary resources to discover their inclination and succeed in pursuing their goals.

Mentoring

Advisors have an immense responsibility to help their students flourish while respecting their personalities and ambitions. I had the honor and opportunity to mentor several students and be mentored by excellent academics and industry professionals. Guided from this experience, I believe a good advisor needs to master three skills: *(i)* find good problems for the right students; *(ii)* plan ahead; *(iii)* continually adapt to the student's and project's needs.

A good advisor finds good problems. For me, this is the most critical phase of a research project. A good problem should be impactful and intellectually challenging. Even as a PhD student advising master students, I spent a lot of time collecting research ideas and discussing them with my peers. This gives me more flexibility when I am asked to suggest a project to a student. I usually suggest projects to students based on their interests rather than their strengths. While the students' skill-set plays a vital role in the project's success, I have observed that once students discover their interest and inclination, they tend to pick up knowledge and cover their weaknesses very fast. For instance, I had the idea of applying profile-guided optimizations (a well-known technique in general-purpose compilers) to programs in the P4 programming language. I chose to propose this as a project to Patrick Wintermeyer, a master student who was very critical of the P4 compiler's limitations during the Advanced Networking class. While Patrick had no background in compilers and his project lasted only 14 weeks, he had enough drive to pick up all the required knowledge quickly. His work led to a HotNets paper.[1]

[1] Patrick Wintermeyer, Maria Apostolaki, Alexander Dietmüller, and Laurent Vanbever. P2GO: P4 Profile-Guided Optimizations. In *Proceedings of the 19th ACM Workshop on Hot Topics in Networks (HotNets'20)*, 2020

A good advisor plans ahead. Thoroughly preparing a project before discussing it with a student is of paramount importance. Preparing entails crystallizing its motivation, problem statement, first steps, and core milestones. For instance, I advised Vamsi Addanki, a master's student at Sorbonne University, Paris. In this case, I prepared a clear problem statement containing three key inefficiencies of the state-of-the-art buffer management algorithm and a straw-man approach to solve them. Starting from there, Vamsi could use his strong mathematical background to pursue his master thesis on this topic and contribute to a project, which later led to a NSDI submission.[2]

[2] Maria Apostolaki, Vamsi Addanki, Manya Ghobadi, and Laurent Vanbever. Plasticine: A Flexible Buffer Management Scheme for Data Center Switches. *Submitted to NSDI'21*

A good advisor adapts to the student and the project. Even in my limited mentoring experience, I found that each student has different needs: some students prefer working independently, while others prefer more close guidance; some need frequent affirmation, others like to be challenged. I am always trying to adapt my style based on the student's needs, incorporating their feedback. Further, some projects might be more challenging than one would have initially anticipated. I try to continually reflect on the situation and acknowledge my misjudgments. For example, I advised Cedric Maire, who was pursuing his master thesis on a project on the anonymity of Ethereum. While I had extensively worked on Bitcoin, I ignored some Ethereum-specific details that complicated Cedric's task. I dealt with this situation by adjusting the project and providing more technical support such that he could successfully finish his project on time.

Teaching

Teachers have an extreme effect on their students' approach to science and their professional future. My teaching style was formed by observing my teachers and peers and by my experience as a Teaching Assistant at ETH Zurich in Advanced Topics in Communication Networks and Discrete Event Systems courses for several semesters. I believe a good teacher needs to: *(i)* keep all students engaged; *(ii)* help students find their interest; and *(iii)* motivate students to think critically and collaborate.

A good teacher keeps *all* students engaged. To do that, I intend to make lecture material relatable to students' everyday life. For instance, when describing BGP, I would explain that every time they connect to a web page, their traffic follows a path via multiple routers, which is calculated by BGP. Moreover, making lectures more interactive helps keep students engaged and allow them to understand the material better. To do so, I would ask intuitive questions, effectively guiding

students to discover knowledge on their own. For instance, when talking about secure routing, I would ask how we could make sure that an Internet provider does not lie in her BGP announcement. Finally, I believe that it is the teacher's responsibility to keep the class *inclusive*. I have observed that some students are more reluctant to interact than others. In such cases, I start small, *e.g.*, ask students to simply vote for or against an answer or ask a question.

A good teacher helps students find their interests. Courses cannot always delve into much depth, but they should provide enough knowledge, tools, and ideas to allow students to discover their interests. I intend to incorporate exciting research questions in all courses, even introductory ones. Doing so will trigger further discussions, curiosity, and even independent research projects for interested students.

A good teacher promotes collaboration and critical thinking. I believe that collaboration promotes effective learning, especially when combined with tasks that encourage creativity. Thus, I intend to include in my classes group projects that require critical thinking. For example, for the Advanced Topics in Communication Networks course, I designed two 7-week projects in which two student groups reimplemented a part of a research paper. I chose two relatively old papers that used conventional networking practices. In effect, students were urged to leverage modern practices (*i.e.*, programmable data planes), which were taught during the course and made their task more manageable. These projects helped the students realize in practice the benefits of recent networking advancements.

Teaching Plan. Given my interdisciplinary research experience on security, networks, and blockchain systems, I would be most skilled and passionate to teach computer networks, network security, and special topics such as cryptocurrencies and programmable data planes at both graduate and undergraduate levels. I am also happy to teach introductory courses in computer science, systems, data structures, and algorithms. Finally, I would be very interested in doing an interdisciplinary seminar in which students from different fields will explain the open problems in their field and share their common practices and toolsets.