Teaching Statement

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Modern society is shaped by the knowledge and skills that we pass on to the next generation. As an academic, my primary goal is to inspire and educate students to become critical thinkers, problem solvers, and lifelong learners. I believe that teaching is a transformative process that empowers students to discover their passion, develop their skills, and contribute to society. My teaching philosophy is centered around creating an inclusive and engaging learning environment that fosters creativity, curiosity, and collaboration. I am committed to providing students with the necessary tools, resources, and support to help them succeed in their academic and professional pursuits.

During my PhD at TU Berlin, I spent 50% of my time[1] in teaching and supervision activites. I have given lectures for 2 courses and served as a teaching assistant for 2 courses for a total of 6 semesters. I have also co-supervised 7 students for their BSc. and MSc. theses, of which 2 projects resulted in top-tier publications, one student is now on a track towards their PhD journey, and the project of one student led them to employment at a major software company. These experiences have fascinated me and motivated me to continuously improve my teaching and mentoring practices to meet my students' needs. As a young academic, 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 and Supervision

Advising is a profound responsibility that calls for a careful blend of guidance, open communication, adaptability, and a shared focus on meaningful outcomes. Through my experiences mentoring students and learning from outstanding mentors, I have come to value three essential qualities in an advisor: *(i)* it is crucial to align each student's unique strengths and interests with specific research problems that both inspire and cultivate their abilities; *(ii)* effective advising involves setting a forward-looking path, with milestones that encourage growth and achievement; *(iii)* a successful advisor remains flexible, adjusting to the evolving needs of the student and project, offering the right balance of support and independence.

A good advisor adapts to the strengths and interests of the student. I have mentored students with diverse backgrounds and interests, ranging from computer networking to machine learning and systems. I have found that the most successful projects are those that align with the student's strengths and ambitions. For example, when advising Jörn-Thorben Hinz, who had a keen interest in both computer networks and operating systems, I encouraged him to explore a project that integrated both areas. This approach not only matched his interests but also led to a workshop publication[†], and he is now thriving at a leading software company.

[1] A common requirement for full-time PhD students in Germany.

[†] Jörn-Thorben Hinz, Vamsi Addanki, Csaba Györgyi, Theo Jepsen, and Stefan Schmid. *"TCP's Third-Eye: Leveraging eBPF for Telemetry-Powered Congestion Control"*. In Proceedings of the ACM Workshop on eBPF and Kernel Extensions (eBPF), ACM SIGCOMM, 2023.

Similarly, I have advised students who were eager to investigate machine learning applications within networked systems and new technologies. Initially, I proposed a project focused on the performance aspects of satellite networks. However, as the students engaged more deeply with the topic, it became clear that they were drawn to the broader implications of environmental factors on satellite performance. Recognizing their interests, we reshaped the project to explore the impact of weather conditions on low-earth-orbit satellite networks, a decision that enhanced their engagement and allowed them to leverage machine learning in their research.

A good advisor sets clear goals and milestones.
Over the course of mentoring several students, I have learned that some thrive with a structured approach, while others prefer a more flexible timeline. I have found that setting clear goals and milestones is essential for guiding students toward successful outcomes.

For instance, while advising Goran Dario Knabe at TU Berlin, I established a series of milestones, including literature review, implementation, and evaluation phases. Specifically, in our work on optical interconnects[□‡], Goran swiftly implemented and evaluated our algorithm within a month. These milestones helped him stay focused and motivated, providing a clear roadmap for the project. This structured approach led to his contributions to two research papers, which are currently under submission at prestigious networking conferences.

In contrast, while supervising another student, Jonas Köppeler, who was more independent and self-motivated, I provided greater flexibility in setting his own goals and timelines. This allowed him to explore different research directions and develop his interests organically. This approach also led to a successful project, and Jonas has now joined our group as a PhD student.

A good advisor invests time & maintains low-latency communication.
During my PhD, I have always made an effort to be available to my students, whether in person or via email. I have found that maintaining low-latency communication is crucial for keeping students engaged and motivated. For example, when advising Sarah-Michelle Hammer on a project related to satellite networks, I made sure to respond promptly, provide timely feedback, and schedule regular meetings to discuss her progress.

In this particular project, we relied on equipment (a Starlink dish and server) located in a remote location near Berlin, an hour away from the city. Although remote access generally worked, there were occasional unexpected issues. I ensured that I and our lab members accompanied her to the site, helped with the setup, and assisted with troubleshooting whenever necessary. This hands-on approach not only helped her complete the project successfully but also resulted in a top-tier publication[⋆] and fostered a sense of collaboration & camaraderie, underscoring the value of being a supportive and accessible advisor.

□ Vamsi Addanki, Chen Avin, Manya Ghobadi, Goran Dario Knabe, and Stefan Schmid. *"Vermilion: Breaking the Throughput Barrier of Periodic Circuit-Switching (A Simple Demand-Aware Optical Interconnect)"*. Under Submission.

‡ Vamsi Addanki, Maciej Pacut, Leon Kellerhals, Goran Dario Knabe, and Stefan Schmid. *"Vermilion, Pt. 2: Augmenting Reconfigurable Optical Network Design with Machine-Learned Predictions"*. Under Submission.

⋆ Sarah-Michelle Hammer, Vamsi Addanki, Max Franke, and Stefan Schmid. *"Starlink Performance through the Edge Router Lens"*. In Proceedings of the ACM Workshop on LEO Networking and Communication (LEO-NET), 2024.

Teaching

Teachers play a pivotal role in shaping how students perceive science and their future careers. My teaching approach has developed through learning from exceptional educators and from my experiences as a teaching assistant at TU Berlin, where I contributed to two courses:

- *Network Protocols and Architectures:* This introductory course covers essential concepts in computer networking, including the OSI model, TCP/IP, routing algorithms, medium access control and error correction. My role included designing and leading tutorials, grading assignments, and providing detailed feedback. In the initial years of my PhD, I conducted tutorials, while in later years, I had the opportunity to deliver lectures in this course.
- *Datacenter Networking and Software-Defined Networks:* I proposed this new course to my professor to introduce students to the timely and impactful topics of datacenter networking and software-defined networking. My professor enthusiastically supported the idea, and I took the initiative to develop the course content from scratch. I designed and delivered the lectures, incorporating hands-on exercises within the sessions. These exercises utilized network simulators and linear programming solvers, providing students with practical, real-world experience to complement their theoretical understanding.

I believe that effective teaching hinges on three core principles: *(i)* actively engaging *all* students, *(ii)* guiding students to discover and pursue their academic interests, and *(iii)* inspiring them to think critically and collaborate effectively.

A good teacher actively engages all students.
To foster an inclusive learning environment, I strive to engage all students, regardless of their background or prior knowledge. I encourage students to participate actively in class discussions, ask questions, and collaborate with their peers. For example, in the Datacenter Networking course, I incorporated group projects that required students to work together on topics related to network simulations and dataplane programming using p4. This approach not only encouraged teamwork but also provided students with practical experience in network design and management. Not only did many students took a career path in networking, this course also attracted students towards research in networking and systems.

Helping students discover and pursue their interests.
An essential part of teaching is guiding students to identify and pursue their academic interests, which fosters a deeper engagement with the material. I strive to create opportunities for students to connect course concepts with their personal goals and areas of curiosity. For instance, in the Datacenter Networks course, one of my students was already developing a P4 programming project through the Google Summer of Code (GSoC) program. He approached me to explore ways to extend his project for application on real-world systems. Recognizing this opportunity, I guided him in expanding his project to adapt his code from the BMv2 switch model to the Tofino architecture, enabling testing on our lab's network testbed. This extension was well-received, enriched his practical experience, and was ultimately recognized as a dedicated project course.

Encouraging critical thinking and collaboration.
I regularly incorporate thought-provoking questions into my lectures and allow a few minutes for students to consider and discuss their responses in groups. This practice not only encourages students to think critically but also fosters collaboration, as they learn to evaluate different perspectives and

build on each other's ideas. In group discussions, students often approach problems from varied angles, leading to richer insights and a more thorough understanding of the topic.

Teaching Plan

Drawing on my research expertise in datacenter networks, including systems, algorithms, and theoretical insights, I am particularly enthusiastic about teaching courses in computer networks, network algorithms, and advanced topics such as datacenter networking and network topologies at both the undergraduate and graduate levels. I would also be happy to teach introductory courses in computer science, including systems, data structures, and algorithms. Additionally, I am excited to develop a seminar where students from networking, systems, and theoretical computer science fields can discuss both longstanding open problems and emerging challenges in their areas, as well as share standard methodologies and tools. This seminar would promote cross-disciplinary collaboration and expose students to diverse problem-solving approaches, particularly encouraging students to apply theoretical insights to practical systems problems.