

Teaching Statement

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Teaching Philosophy

My teaching is guided by a conviction that a university education in computer science must simultaneously develop deep technical mastery, the capacity for independent inquiry, and the habit of situating technology within its broader social and ethical context. At a research university, teaching and research are not competing activities but mutually reinforcing ones: the classroom is where I articulate and test ideas, and research is where I generate the problems and results that keep teaching vital and current.

Three principles shape my practice across all courses and levels:

- **Conceptual foundations before tools:** I emphasize principles - protocol design, distributed-systems reasoning, optimization, and statistical inference - that remain relevant as technologies change.
- **Research proximity:** At the graduate level, I bring students close to the frontier through seminal papers, open problems, and examples from ongoing work in my group.
- **Active and collaborative learning:** I use problem-solving sessions, paper discussions, project presentations, and laboratories so that students practice creative technical reasoning rather than passively receive material.

Teaching Portfolio

My teaching portfolio at the University of Göttingen spans Bachelor's and Master's programmes and has evolved with the field while retaining a stable core in computer networking.

Core Networking (BSc)

Computer Networks is the foundational Bachelor's course taught each winter semester, covering the protocol stack from link-layer mechanisms through routing, transport, and application-layer services. It combines classical concepts - reliable data transfer, congestion control, naming, addressing, and routing - with current topics such as software-defined networking and network security. The accompanying Practical Course Networking Lab gives students hands-on experience with packet capture, routing configuration, and network programming.

At the Master's level, I offer advanced courses that connect networking with AI, data science, and computational social systems:

Advanced and Specialised Courses (MSc)

At the Master's level, the portfolio addresses four distinct areas, each taught as an annual or biannual offering:

- **AI-Empowered Networking and Mobile Communications** covers reinforcement learning for network control, neural-enhanced video streaming, LLM inference at the edge, and multi-agent communication. Projects often connect to recent conference papers and ongoing group research.
- **Advanced Topics in AI for Computing and Networking** addresses transformer architectures, efficient training, federated learning, and applications to distributed systems. Co-teaching with doctoral researchers exposes students directly to active research thinking.
- **Social Networks and Big Data** introduces graph models, community detection, influence propagation, and large-scale data processing for students in computer science, the social sciences, and the digital humanities.
- **Data Science in Smart City** uses mobility, energy, social-media, and sensor datasets to teach data collection, preprocessing, modeling, and policy interpretation through team projects, often with city or ENLIGHT partners.

Seminars

Seminar on Internet Technologies and seminars Advanced Topics on Computer Networking/Mobile Communications/AI for Networking run every semester and are the main vehicle for introducing Bachelor's and Master's students to research literature. Students select recent papers or technical materials, write summaries, and present their critical reviews in guided discussions. Since I launched these seminar series in 2006, they have introduced hundreds of students to academic research practice. I have also introduced a Social Networks and Big Data seminar, combining technical

sources with literature from the social and behavioral sciences to cultivate reflective, cross-disciplinary thinking.

I have also developed block courses in response to field shifts, including Software-Defined Networking (2014-2019) and Blockchain Technology (2018-2019). These topics were later integrated into the regular curriculum or retired as the field matured, reflecting a deliberate responsiveness in curriculum design.

Research Supervision and Mentoring

Advising doctoral researchers is, I believe, the most intellectually demanding and most consequential dimension of academic teaching. Over the years I have supervised more than forty PhD graduates to completion. These researchers now hold faculty positions at universities across Europe, Asia, and North America, and occupy research and leadership roles in companies including major technology firms and telecommunications providers.

My approach to PhD supervision balances structured guidance with progressive intellectual independence. In the early years, doctoral students work closely with me and with postdoctoral researchers on problems that are well-scoped but open, developing technical skills and academic writing in parallel. As students mature, I deliberately step back, encouraging them to define their own research questions, lead collaborations, and engage independently with the broader community through conference presentations and reviewing roles. I view the production of independent scholars as the highest measure of supervisory success.

The diversity of the group—currently including PhD students from Germany, China, and other countries, a Humboldt Foundation Scholar, and a junior group leader—enriches both the research environment and the teaching culture. International visiting PhD students, supported through bilateral agreements and EU mobility programmes, further broaden the group's intellectual scope.

Curriculum Development and Innovation

Over the course of my tenure I have substantially revised and expanded the networking curriculum at Göttingen. After I joined Göttingen in 2002, I created core offering consisting of a single networking course (then titled Telematik) and later a practical lab. The curriculum now includes eight to ten courses per year across both semesters, covering the full spectrum from protocol fundamentals to AI-empowered networking, smart cities, and digital humanities.

Several specific innovations are worth noting. The Data Science in Smart City course introduced project-based learning with real urban datasets at a time when this approach was uncommon in European CS curricula. The AI-Empowered Networking course was, to my knowledge, among the first at a German university to systematically address LLM systems from a networking perspective. The Social Networks and Big Data seminar reflects a commitment to integrating both methods from social and behavior sciences and data/AI competences into the curriculum.

I participate actively in the ENLIGHT European University Alliance, which brings together nine European research universities. Through ENLIGHT, I have contributed to joint course development, student exchange, and curriculum harmonisation, and I supervise students from partner institutions. I am particularly involved in the DISRUPT project, an ENLIGHT Thematic Network (2024–2027), which will yield shared educational resources on digital innovation for urban transitions across six ENLIGHT institutions. I am also in charge of the PhD in Computer Science programme at the University of Göttingen, and help create and coordinate a joint PhD programme with the University of Sydney.

Future Teaching Directions

Looking ahead, I intend to develop teaching in three directions:

- **AI systems as a first-class networking topic:** As LLM inference and distributed AI training become central networking workloads, I will deepen the coverage of AI system design—memory hierarchies, communication patterns, hardware constraints—within the networking curriculum.
- **Interdisciplinary joint programmes:** Building on the Smart City and Social Networks courses, I will pursue formally joint teaching with colleagues in the social and economic sciences, urban planning, and digital humanities, reflecting the genuinely interdisciplinary character of the research questions that motivate much of my work.
- **Textbooks and open educational resources:** As part of my ENLIGHT and DISRUPT commitments, I will develop textbooks and openly licensed teaching materials in key areas—networking fundamentals, AI for networked systems, social computing, and data science for cities—that can support local teaching, joint programmes, and wider adoption across partner institutions.

Teaching, at its best, is a long-term investment in the intellectual infrastructure of the field. I remain committed to making that investment with the same rigour and ambition that I bring to my research.