

COINS study tour

2013-04-16 to 2013-04-19.

Hanno Langweg, Einar Sneekenes (HiG)

Seven institutions were selected to collect their experience with Ph.D. training in security and computer science. The selection comprised universities and research institutes in Germany and in Luxembourg. All training programmes had been operating for several years, and all programmes included security as their main focus or as one area of specialisation.

Topics that were discussed with representatives of all schools included the added value of a research school for Ph.D. training, specifics of security and computer science related to Ph.D. training, cooperation with partners that compete for resources outside of the school, long-term strategic goals, and typical mistakes in starting and running a research school.

Observations

1. Research schools involving a research institute and a university seem to be more driven/promoted/demanded by the research institute.
2. Research schools cooperate with local masters programmes to recruit candidates.
3. Significant effort is put into recruiting.
4. Research schools follow up on students' progression more closely (in addition to individual thesis advisors) and are interested in high completion rate.
5. Training modules are often optional and participation is documented outside of a formal transcript.
6. The structure of a research school is used as a brand.
7. Organisational issues should be dealt with early and they should be communicated clearly.

HRSST Helmholtz Research School on Security Technologies

In the beginning, both Helmholtz Gesellschaft and TU Berlin had "a will, a wish and the money" to start a research school. The proposal was cross-domain and multidisciplinary, and the human being factor was also considered a plus in finding a good balance between security and individual rights.

The Ph.D. training programme at DLR (without a degree) was created from a need for structured training that universities did not offer. General skills training is part of all Helmholtz schools. Often, universities are approached late, i.e. in last year of a Ph.D. project, to formally examine and award the degree. HRSST changed this model and provides cooperation from beginning of a Ph.D. project. Currently, this covers only some students at DLR, not all. There are currently 21 doctoral students enrolled in HRSST. Interviews with applicants are done by phone or Skype, followed by on site presentations and by examination of their motivation.

HRSST has a focus on security technologies, including an own production line for silicon products in Frankfurt/Oder and debug capabilities for silicon products. Multidisciplinarity and focus on few topics/institutes turned out to be good. Some consider it to be most important to link engineering with social sciences. Connecting technology disciplines is easy, handling people is hard.

A wide range of postgraduate education modules are offered by the school, e.g. courses, summer schools, tutorials. A large amount of time can be spent with the education programme, an estimated 25% of the time of a doctoral student participating in all possible events.

Vulnerability discovery research and cheaper machines for attacks give good visibility. It is important to find a balance between pointing out problems and showing that good work is done. The school helps to speak with a uniform voice when applying for funding, e.g. for a competence centre. HRSST is through its partner TU Berlin involved in the EIT ICT masters programme, other than that, the school has no formal cooperation agreements.

CASED/EC SPRIDE Graduate School

CASED is funded 2008-2014 by non-used funds reserved for co-funding the state of Hesse's participation in the federal excellence initiative. EC SPRIDE is funded by the federal ministry of research, BMBF, as a competence centre in IT security 2011-2019 (with an evaluation 2015). CASED assembles 150 Ph.D. students and 70 researchers from Fraunhofer SIT who have completed a masters degree, ranging from computer science, electrical engineering, physics, mathematics, mechanical engineering to philosophy and economics. Everybody was encouraged to join in the beginning. Big numbers proved to be good for reporting.

Students demand general skills training/courses as an optional choice. CASED offered general skills training in the beginning, but focuses now more on CS-specific training. The reason is the availability of Ingenium, the TUD support/graduate school that offers general skills training for all Ph.D. students at the university, regardless of discipline. Courses comprise time management, self-management, project management, presentation techniques, intercultural competence, introduction to national academic culture, academic writing, proposal writing, management competence, team supervision, career advice, thesis supervision, didactic. CASED offers topic-wise courses organised by professors or faculties. Specific to computer science are courses on conference publication and presentation, as conferences are the main publication venues in computer science. Transferable skills courses seem to have improved the quality of papers sent to high profile conferences.

There is mutual recognition of Ph.D. courses taught at TU Darmstadt and Hochschule Darmstadt.

CASED is no independent organisation/legal entity, it is only a brand like the Star Alliance in air traffic. TUD issues a certificate of attended courses under the CASED label on request. Ingenium issues a certificate of courses taken; this certificate is independent from a diploma supplement. Collaboration was build bottom-up and topic-wise. There is no cooperation with other research schools.

A top-down approach in offering courses did not work well. Now, Ph.D. students have to organise specialised courses themselves. This helps to reduce the number of no-shows. Ingenium organises a welcome event to explain the value of structured doctoral training to students.

KIT/KASTEL Competence Centre for Applied Security Technology

Ph.D. students in computer science at KIT are typically remunerated in two ways: either as an employee with teaching/project work or by having a stipend. Stipends are rare and often awarded by DFG; Ph.D. students having a stipend have no obligations towards KIT outside of the Ph.D.

programme. Stipends by DFG are sometimes connected to a more structured Ph.D. training. Employed Ph.D. students typically spend 4-5 years on their Ph.D. while Ph.D. students on a stipend often finish after 3 years.

KIT has ca. 300 Ph.D. students in computer science. 10%-20% of Ph.D. students stay in academia, 90%-90% work in industry after graduation. Recruitment happens mostly from KIT's own masters programme that supplies more than 50% of Ph.D. candidates. KIT favours "lightweight structures", i.e. does not focus on structured Ph.D. training and emphasizes the importance of the relationship between Ph.D. student and thesis advisor.

KASTEL is a competence centre receiving funding from BMBF, and is run like a project. There are ten groups with 1 Ph.D. student each and sometimes additional funding sources. Thesis committee members might be drawn from different disciplines, depending on the thesis topic.

A goal is to find a common/intermediate language so that people from software engineering, verification, and cryptography can communicate with each other. Application areas are smart home, cloud computing, and privacy-preserving surveillance. Basic research questions that are addressed are "How to define security?", "How to develop secure systems?", "How to prove security?"

Cooperation for writing the application for KASTEL was easy because of the prospect for funding. In executing the project, milestones need to be reached, and this requires cooperation. Including law people in a technical consortium turned out to be a good idea because of the right topics.

IMPRS-CS International Max Planck Research School for Computer Science

The research school started ca. 2000/2001 as a joint cooperation between Max Planck institutes and the computer science department at University of Saarbrücken. Funding is provided by Max Planck Gesellschaft with a budget of 230,000 EUR p.a. About 130 doctoral students are enrolled in the school, as well as some master students on scholarships. Students are either employed or have a scholarship. Ca. 65% come from abroad (China, India, Eastern Europe, Iran, Palestine). Most students stay in the same area of computer science that was their focus of their previous degree and those from the local campus usually stay with the same advisor. Many Ph.D. students have two advisors. All students are also enrolled in the University of Saarbrücken graduate school. MPI wants the students after their masters degree, the university wants students already after their bachelors degree.

Main motivation to set up the school was to create more visibility to the outside world, and to cooperate with the university for common recruiting. There are three rounds of admission every year, in addition to students graduating from the local university. Candidates are screened by their documentation, invited to give a presentation, interviewed on site, and a hiring decision is made by committee. Advisors are supported by a preceding central review of academic credentials. The school provides assistance with visa and accommodation.

Different ways for recruiting in terms of entry requirements have been tried in the past. Entry exams worked less well than presentations by students and interviews. Bringing in students is worth it, Skype is seldom used. Typically five students are invited to fill one open position. Invitation is based on documentation only, there are no pre-screening interviews. The recruiting event is attended by

the admission committee and by faculty. Internships are rarely used by the university, mostly in cases where candidates switch areas after their first degree.

There is no requirement to take courses, which courses are taken is decided on an individual basis. Scientific courses are typically picked by advisors/faculty while optional general skills training is typically chosen by students. Teaching how to write a conference paper is considered the task of a thesis advisor and not offered as part of formal training. Certificates are issued to document participation in the school. The certificates look like a transcript, but only pass/fail grades are given for courses.

Identified success factors are that the school is open to all students at MPI, the support staff keeps an open door for those admitted (shared with the person dealing with international guests), and there is a buddy programme. All research schools within MPG exchange experiences on a common intranet and at an annual meeting.

Saarbrücken Graduate School of Computer Science

The idea of the graduate school is to provide a culture around Ph.D. training and to provide accompanying services. Identity is important for students enrolled in a Ph.D. programme. Currently, ca. 400 doctoral students are part of the graduate school. The school provides a continual support structure, all faculty members are committed to getting doctoral students to complete.

With the start of the graduate school some years ago a qualifying exam was introduced that takes place half a year after enrolling in the Ph.D. programme. The exam is an oral exam, featuring the advisor, a committee member of the graduate school, and a faculty member proposed by the candidate. The aim of the qualifying exam is to convince three people that it is likely the candidate will complete a doctorate. Areas of concern are the initial research, the motivation, and the presentation.

Inspired by CMU's Black Friday, all 400 students are discussed by all faculty once a year (often 90% attendance). Top and bottom performers are interesting, the middle 75% are not much discussed. A lot of preparation is required by the committee.

The graduate school needs to be recognisable to be valuable for recruiting. The graduate school tried summer schools for bachelor students to recruit students from other places; this did not work, attendance was unsatisfactory as well as was recruitment. Sometimes students switch to other institutions after exposure to exciting external researchers.

Some students receive funding in a preparatory phase (ca. 18-24 months) prior to starting their Ph.D. projects. These students are expected to mention this funding in publications.

Soft skills courses are difficult to fill, e.g. courses on communication strategies. The reason is unknown.

University of Luxembourg DS-CSCE Doctoral School of Computer Science and Computer Engineering

A goal of the school is to provide employable candidates, not (only) abstract scientists.

There are currently 90 doctoral students enrolled in the school. The Ph.D. programme expects students to finish within four years, leading to ca. 20 defences/intakes per year. There is no joint call for applications. Other disciplines, like biology, finance, have joint calls. Interested candidates have to find a supervisor. The biggest problem is to recruit students. Only completed computer science candidates are recruited to eliminate the need for retraining. An advisory board is appointed for Ph.D. project, usually comprising the same people as the theses committee. The advisory board discusses annual progress reports.

The school is an institution for community building, with 90 doctoral students being sufficient to meet within computer science as a discipline. It is not required to meet/collaborate with students in other disciplines. Computer science is the biggest research unit in the university. Ca. 2009/2010 it was decided to install structures to handle a larger number of Ph.D. students. That approach was later expanded to other disciplines. It started as a bottom-up initiative, was then organised top-down, and later adapted in a central framework. The school might evolve to larger entities at faculty level with separate programmes. Community building would then happen, e.g., for the whole science faculty, with a programme in computer science. There was a discussion about the terminology: "doctoral school" (after masters degree) versus "graduate school" (after bachelors degree, leading to scientific master before starting a research project). The term doctoral school was chosen.

Training modules cover basic scientific teaching, conference attendance, seminar presentation. A total of 20 ECTS are required by each student, the amount was chosen arbitrarily. Participation is documented in a diploma supplement. At first, explicit events were certified reluctantly. Later, it turned out to be good for quality assurance. Certified events could also be counted towards teaching load of professors, and that led to more professors contributing.

The ability to promote doctoral training as a brand turned out to be of significant importance.