

Final report on internship supported by COINS

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This report is a short description of my internship supported by COINS's short-term mobility plan. In this report, I have mainly incorporated my experience at the Research Institute of Sweden (RISE), as the research mentor of three master students working on their thesis. These students were recruited to work on a master thesis project defined by RISE. All the students from different universities and research institutes, including KTH Royal Institute of Technology, Stockholm University, and the Chalmers University of Technology, were able to apply for this project. The project aims to design, develop, and evaluate socio-technical serious games in cyber ranges.

Appropriate training is an effective solution to tackle the evolving threat landscape and conflicts in the cyber domain and to fulfill security requirements. Serious games demonstrate pedagogic effectiveness in this field, however, they need to comply with national, organizational, and individual strategies and characteristics. These games provide the players, individually or in groups, with an opportunity to develop their adversarial and system thinking skills to set up effective defenses. To this end, this project plans to employ the finding of these theses to raise security awareness. The master theses consider the complex nature of the cyber domain, the knowledge and motivation of participants, and the experiential learning using cyber ranges. The students' work is based on existing frameworks and integrates their advantages to design and develop new serious games in cyber ranges.

Due to the restrictions and measures in Stockholm, we were not able to have physical meetings. However, the weekly online meetings with the students and supervisors provided us with the opportunities to discuss scientific and administrative issues thoroughly. These meetings are still going on. In addition to these meetings, I was available to answer the students' questions via email. In collaboration with the supervisors, I was mainly involved in the literature review, understanding and formulation of the research problem and research questions, and determining the research methodologies of the theses. Two of the students work on a serious game on zero-day markets, and the other student works on designing and developing a megagame based on the Cyber 9/12 Strategy Challenge. As a participating member in 2019, 2020 and the coach of participating team in 2021 in this challenge, I tried to help this student to design the megagame efficiently. A megagame is a type of large-scale simulation that can contain elements of role-playing games, tabletop games, LARPs and

wargames - the amount of these is dependent on the scenario being played and the way the players choose to engage with the scenario. The scenarios are based on the fictional scenarios presented in the Cyber 9/12 Strategy Challenge. The outcomes of this project will be published after the presentation of master theses by the students.

This project enabled me to work on my proposed framework presented in the first workshop on Cyber Range Technologies and Applications (CACOE), one of the workshops at 2019 IEEE European Symposium on Security and Privacy. The students are inspired by this framework, and the guidelines demonstrated in the paper facilitated their research and development process within this project. During this time, I was also privileged to collaborate with Professor Ilia Bider, Stockholm University, and expand my knowledge on Enterprise Architecture and Business Processes Management. These concepts are essential parts of the developed games through this project. I also attended the Conference on "Security for Industry - How to avoid a Cyber attack", organized by KTH Royal Institute of Technology. The aim of this conference was to bring together academia, industry and other stakeholders around this critical theme.

To sum up, this internship provided me with a valuable opportunity to work with multiple research groups in Sweden. We worked on an interdisciplinary topic that requires knowledge from different areas and fields. This enabled me to view my own research problem, cybersecurity economics, from other perspectives. I would like to thank Associate Professor Hanno Langweg and Urszula Nowostawska, who helped me plan this internship. Moreover, I appreciate the financial support by COINS.