CyberSEA Research Lab
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Systems and Computer Engineering
Carleton University
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Position Available: M.A.Sc. Candidate
Analyzing the Behavioural Security Posture of Software Systems

The Cyber Security Evaluation and Assurance (CyberSEA) Research Lab at Carleton University is actively looking for a graduate student at the Master's level to contribute to a funded research project starting in September 2022.

Project Description

The need to address security concerns early in the system's development (prior to its implementation) is well-documented in the literature. System architects, developers, evaluators, and certifiers are generally the individuals who are involved in a system's design and evaluation process. These individuals need better ways to measure and evaluate system security, as well as adequate tool support to help integrate evaluation approaches into their workflows to make critical design decisions.

While a number of security metrics exist, it is unlikely that a single security metric can sufficiently assess various characteristics relating to the security of a system. Instead, similar to how a system's design is better represented through its multiple views (structural, behavioural, functional), a combination of security metrics that provide different perspectives is likely to better reflect the security of a system.

We describe a system's security posture as its security state at a specific point in time that reflects its ability to defend against knowable threats that affect it. While we cannot quantitatively represent a system's security posture as a single quantity, we can provide quantifiable insights on the system's security level based on the views of the system (e.g., structural, functional, behavioural). Each view of a system encompasses several metrics to reflect specific security properties of the system associated with that view. These metrics serve as indicators of a system's security posture for a given view. In previous work, we focussed on defining the on evaluating only the structural view of the system. In this project, we seek to turn our attention to the behavioural view of a system.

Project Keywords:

- cybersecurity
- risk assessment
- security metrics
- security posture
- software design
- behavioural view
- data science
- programming

Objectives

The overall aim of this project is to study a system's security posture from its behavioural view. This will involve the following activities and tasks:

(1) Adopting and/or defining a collection of metrics that can be used to reflect the security characteristics of a system by examining its behavioural view;

(2) Developing an approach for calculating and analyzing the behavioural security posture of a system based on the adopted/defined metrics; and

(3) Implementing software tool support for the developed approach to support system designers in improving system security.

Related Literature References

[1] J. Samuel, J. Jaskolka, and G.O.M. Yee. Analyzing structural security posture to evaluate system design decisions. In *Proceedings of the 21st IEEE International Conference on Software Quality, Reliability, and Security*, QRS 2021, pages 1-12, Hainan Island, China, 2021. (To Appear).

[2] J. Samuel. A Data-Driven Approach to Evaluate the Security of System Designs. Master's Thesis, Carleton University, Ottawa, ON, Canada. 2021.

[3] J. Samuel, J. Jaskolka, and G.O.M. Yee. Leveraging external data sources to enhance secure system design. In *Proceedings of the 2021 Conference on Reconciling Data Analytics, Automation, Privacy, and Security: A Big Data Challenge*, RDAAPS 2021, pages 1–8, Hamilton, ON, Canada, May 2021.

[4] G.O.M. Yee. Modeling and reducing the attack surface in software systems. In *2019 IEEE/ACM 11th International Workshop on Modelling in Software Engineering* (MiSE), pages 55–62, May 2019.

Desired Skills/Qualifications

Suitable candidates will have a Bachelor's degree in Software Engineering, Computer Science, or a related field. Ideal candidates will be self-motivated with an ability to work independently and to communicate effectively in a team environment. A background in computer security, software engineering concepts, and logic and discrete mathematics is highly desirable. Experience with metrics and measurement and software development is considered an asset.

All candidates must satisfy the Minimum Admission Requirements for Master's Programs at Carleton University. International candidates must also ensure that they satisfy the English as a Second Language Requirements. In all cases, these requirements will be strictly enforced when evaluating an application for admission.

Funding

Successful candidates for this position will be *eligible for funding* in the form of a research assistantship. Specific funding details are determined at the time of offer and consider numerous factors such as academic standing, research potential, availability of funds, eligibility for teaching assistantship and/or scholarships, etc.

Host Research Institute Information

Carleton University is a public comprehensive university, founded in 1942, in Ottawa, Ontario, Canada. The research-intensive Faculty of Engineering and Design at Carleton University is recognized as one of Canada's leading institutions in the study and research of engineering, architecture, industrial design and information technology. Since the inception of engineering at Carleton in 1945, our experts have pushed the bounds of innovation and discovery. Carleton focuses on anticipating the needs of industry and society, and offers forward-thinking programs with real world application and produces research that is helping to shape our present and future. The Department of Systems and Computer Engineering is a recognized world-class institution in software engineering, computer systems engineering, communications engineering, and biomedical engineering. Together with the Department of Electronics, the Department of Systems and Computer Engineering constitutes one of the largest and most research-intensive centres for Electrical and Computer Engineering and Software Engineering education and research in Canada. The Cyber Security Evaluation and Assurance (CyberSEA) Research Lab conducts advanced academic research to develop systematic and rigorous approaches for evaluating and assuring the cyber security of software-dependent systems.

Further Information

For more information about Graduate Studies at Carleton University and the Department of Systems and Computer Engineering, please visit: https://carleton.ca/sce/graduate-studies/. For more information about applying for Graduate Studies at Carleton University, please visit: https://graduate.carleton.ca/apply-online/. For more information about funding for Graduate Studies, please visit: https://graduate.carleton.ca/financial-assistance/admissions-funding/.

How to Apply

Interested applicants are to send a **CV** and **Statement of Interest** detailing your research interests, background, and experience by email to the CyberSEA Lab Director:

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For more information about how to apply, please visit: https://carleton.ca/cybersea/positions-available/

Application Deadline

Applications will be reviewed as they arrive until a suitable candidate is found.