The University of North Carolina at Chapel Hill (UNC-CH) and The University of Technology, Jamaica (UTech) collaboration continues to reap success.

The collaboration on curriculum development and capacity building in Computer Security between UNC-CH and UTech Jamaica continues to reap success. The collaboration was spearheaded by the efforts of Dr. Thorpe and Dr. Monrose in 2015. Through this collaboration, the School of Computing & Information Technology has seen vast improvements in the undergraduate computer security curriculum as well as international exposure for both students and staff within SCIT. Recall that in 2015, Mr. Kedrian James was invited by Professor Fabian Monrose to participate in his "*Introduction to Computer Security"* course being taught at UNC-CH. The main objective was to use the experience to design a similar course for the SCIT. Upon Mr. James' return to Jamaica, a course entitled *"Software and Systems Security"* was created, and had its first offering in semester two (2) of the 2015/6 academic year. The course reviews clearly reflect the fact that the majority of the students who took the course found the experience very rewarding. Indeed, after graduating, many of the students ended up being the preferred candidates for competitive cyber security jobs in well established companies in the region.

In semester two of academic year 2016/7, a group of four students were selected by Mr. Kedrian James to participate remotely in the third Annual Cyber Security Competition held as part of Professor Monrose's *Introduction to Computer Security* course. Ten (10) teams participated in a tournament based on a challenge-based game framework, called Riposte[1], that was built to support active learning exercises in protocol and binary reverse engineering. In Riposte, student learners are challenged to find ways to defeat automated clients (that, for example, collude against the learner) in a top-down multi-player shooter game. As the learners' skills improve (e.g., by reaching different levels in the game), the automated clients also adapt their offensive strategies, thereby forcing the learner(s) to enhance their own skills to reach the next level. To stay atop the leaderboard, learners can choose to collaborate to accomplish several tasks, including taking advantage of weak client authentication, abusing weaknesses in data confidentiality to decrypt client-server messages, leveraging weaknesses in integrity protections to unmask new game functionality, mapping network messages to game play, or redirecting inbuilt functionality within the game.

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[1] The term for a counterattack or quick retaliatory move in fencing. See the Riposte video and slides at https://riposte.cs.unc.edu.

For educators, like Mr. James, the framework provides mechanisms that allow for a fresh version of the game client to be downloaded every time client connects to the game server, thereby encouraging learners to design automated ways to modify a new client or adapt their existing (modified) client in ways that still abide to the learned protocol specifications. Mr. James' 4-person technical team from UTECH (led by SCIT student Lomar Lily) had a valiant showing in the 2017 tournament, but were ultimately defeated in the quarter-finals. The expectation is that Mr. James will utilize the equipment loaned to UTECH in 2016 to host a Riposte game server for students in his Software and Systems Security course, so that similar competitions may be held in Jamaica and the Caribbean region at large.

Mr. Kedrian James (left), Mr. Lomar Lily (Right) and Dr. Fabian Monrose. Lomar accepted several prizes on behalf of members of his team back at UTECH.

As a direct outcome of the team's stellar performance in the competition, an invitation was extended to Mr. Kedrian James to accompany Professor Monrose and his research group to the USENIX Security Symposium held in Vancouver, British Columbia from August 14 – 19, 2017. The symposium, now in its 26th year, is a premier venue for security and privacy research, and brings together researchers from both industry and academia to discuss the latest on improving computer security. The 2017 program consisted of 85 research papers, invited talks from leaders in industry, and professional and social events. According to Professor Monrose,

“participation in the Symposium serves as a great opportunity for Mr. James to get exposed to cutting-edge research and teachings which he can incorporate in his lectures at UTech. His students will directly benefit from his presence at the Symposium.”

Mr. Lomar Lily presenting his research on weaknesses in the popular WhatsApp service.

In addition to the invitation to the conference, both Mr. James and Mr. Lomar Lily were invited to UNC-CH. During his one week stay at UNC-CH, Mr. Lily attended lectures given by several Professors in their courses on *Modern Web Programming, Introduction to Robotics, and Digital Logic & Computer Design*. In addition to attending classes, Mr. Lily completed new, challenge-based, active learning exercises under development for undergraduate students at UNC. He also presented a joint research project (with Agyei Masters and Kadie Chance). That work won first in the inaugural Software and System Security Research awards event held within SCIT in April 2017. The presentation was made in the presence of Professor Monrose along with members of his research group, including Dr. Sanjeev Das, Jan Werner, Murray Anderegg, Ryan Court, and Mac Malone. Overall, the visit proved to be highly rewarding for all the participants, fueling Mr. Lily’s passion for Computer Science even further.

Week two involved a review of the syllabus and active learning labs Mr. James had designed and implemented for his Software and Systems Security course at UTech. Of particular note were engaging discussions about impressive course projects that were performed by students of Mr. Kedrian’s course, and ways in which these projects could be further extended for

submission to scholarly venues. These discussions lead to several ideas on techniques for improving the security of Internet of Things (IoT) devices, mobile forensics, and multi-factor authentication. We look forward to exploring collaborative research in these (and other) security topics under the existing initiative between the two institutions in 2018 and beyond. We hope that SCIT, or other supportive initiatives at UTECH, will be able to secure funds to facilitate such collaborations between the scholars and build stronger ties between the institutions.

SCIT Students who participated in the 3rd Annual Cyber Security event host by the Computer Science department at UNC-CH display their winnings upon Lily's return to Jamaica. Left to Right: Agyei Masters, Kevon Graham, Westley Maragh and Lomar Lily.