Thesis Project Portfolio

CS XXXX: Cybersecurity in the Cloud

(Technical Report)

Internet of Things Devices: Convenience, But at What Cost?

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

(Executive Summary)

It's More Than an Assignment

"If it's due tomorrow, do it tomorrow." These were the words I had lived by throughout my years in high school. It had become such a big part of my philosophy that I had gotten to the point where I said these exact words in my high school graduation speech. What I didn't know at the time was why this was the case. After completing 4 years of college and going through many courses, I have found the answer. From my first day at the University of Virginia, I knew it was an extraordinary place. The freedom to make choices in both how I lived and what I learned was refreshing. In high school, I was told what classes to take and when to take them. Here, I got to choose which courses I wanted to take and had the ability to shape my path. I was proactive with my assignments and even my course schedule for upcoming semesters. The same guy that was putting off work until the last possible day began planning far ahead. After completing my capstone project and reflecting on my experiences at UVA, I realized this change in behavior stemmed from genuine interest in what I was doing. As someone who has always been a tech enthusiast, I took this opportunity to embrace it when selecting courses and even selecting the topic for my STS research and Capstone project. I knew that by focusing on something that was meaningful to me, I would be able to make a strong impact with my work. However, instead of focusing on what has driven my interest, I decided to investigate issues that have deterred others' interest.

In my STS research, I explored how Internet of Things (IoT) devices were impacting the privacy of their users. I came across multiple cases where companies tracked user data without the knowledge of the users. A prominent example of this issue was when "Target mined a client's

purchasing habits, predicted that she was pregnant, and [sent] a mailer promoting baby items to her home. As it turns out, she was still in high school and, while she was in fact pregnant, her family did not know; they literally found out because of the mailer" (Allhoff & Henschke, 2018, n.p.). As a user of IoT devices, I have enjoyed the convenience and benefits that they have provided; however, I have also encountered people who would never use them. I had heard about various scandals and cases of misuse but I never considered why it happens. As a tech enthusiast, I have had this bias of looking at technology through a lens of innovation and have fixated my attention on the benefits. But for my research, I needed to set aside my bias and understand the problem in order to propose a solution. I noticed that the government has always been *behind the times* and more reactive than proactive. Laws and regulations have been set forth after a technology has been misused. My research helped highlight the origin of the negative attitude and distrust towards technology. Through the observation of the cyclic behavior of corporate misuse of technology followed by reactions by the government, I was able to diagnose the issue and propose a system that focuses on bringing the government up to speed instead of looking into all of the actors at once. Because the government is usually lagging in the realm of technology, innovations go directly to the technology companies. By asserting the government in between the innovators and the technology companies, the government could effectively evaluate and regulate new innovations so that producers cannot exploit loopholes at the expense of users. In addition, the government could also explore opportunities to implement those same technologies to benefit society. These actions would help alleviate many of the concerns that people have with IoT devices as the government would be more hands-on and involved with the processes, meaning that the people of our democracy would have a voice.

The technical portion of my thesis focused on the engineering aspect of privacy and security. Cloud computing has grown immensely in the past years and many companies have begun using it as their infrastructure. A study conducted by Synergy Research Group (2020) found that "annual spending on cloud infrastructure services has gone from virtually zero to almost $100 billion" (n.p.). This is relevant as IoT devices also communicate through the cloud. By proposing a new course at the University of Virginia that focuses on cybersecurity in the cloud, I believe future engineers could be better equipped to manage data in a safe manner. I realized that the best opportunity to address the ethical and security issues we face with the use of technology by companies would be through changing the mindsets of the engineers who work there. The course has been designed to touch on ethical concerns of handling user data and external regulations such as HIPAA, FERPA, and COPPA that would help engineers make better choices in the future. By better educating engineering students, this course can help make a difference in the way technology is implemented and how people's data is handled.

While this was an overview of my Capstone and STS research process, I want to leave you with some advice for when you commence your journey. Don't be afraid to pursue what interests you. During your time at UVA, take the classes that you need for your major but don't be afraid to explore and venture beyond the scope of your discipline. I learned that I naturally was spending more time and effort on tasks that I was genuinely interested in. Keep that in mind when thinking about your STS research and Capstone. Aim to make a change that you genuinely want to see in the world, not one that will simply fulfill your degree requirements. What does any of this have to do with procrastinating? If you're truly passionate and curious about your topic, you won't be able to put it off.

Resources

Allhoff, F., & Henschke, A. (2018). The Internet of Things: Foundational ethical issues. *Internet of Things, 1-2,* 55-66. doi:10.1016/j.iot.2018.08.005

Synergy Research Group. (2020, January 6). *The Decade's Megatrends in Numbers – Part 1: Cloud Goes from 0 to 100 in Ten Years while Enterprise Data Center Spending Stagnates*. Synergy Research Group. https://www.srgresearch.com/articles/the-decades-megatrends-in-numbers-part-1.