

Staunton Makerspace Communication and Classes Management Systems
(Technical Report)

**An Ethical Analysis of the Actions of the Developers of the Stuxnet Computer Virus using
Just War Theory**
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Socio-technical Synthesis

My capstone team's technical project and my individual STS research are fairly disparate, but are somewhat alike in that they both deal with deficiencies of computer systems. All computer systems have flaws, ranging from usability issues to security vulnerabilities to performance bottlenecks. My team's technical project revolves around the development of a system that will allow members of the Staunton Makerspace to communicate with each other more effectively, while my STS research focuses on the ethical evaluation of the Stuxnet computer virus which destroyed a large portion of Iran's nuclear enrichment capabilities. While they approach two different issues relating to computing deficiencies, each has the capacity to inform the other: any application, no matter how small-scale, must be infused with security measures lest it be rendered unusable. Conversely, deployed viruses should not reach a level of complexity where its human facilitators are unable to have it be an effective tool in reaping the desired payload.

The focus of my capstone team's technical project was to design a communication application for use by the members of the Staunton Makerspace, located in Staunton, VA. The Makerspace's main issue prior to our project's completion was getting information out to its members in an effective manner. A number of the Makerspace's members are not exceedingly technologically adept, and as such they were not happy about having to log into their email and slack accounts to receive new relevant information. Our development team took this aim to heart and built an application from the ground up using Django (a Python web development framework) as well as Javascript and other tools for collaboration and testing. In the end we had completed a system that displays messages that have been sent directly to a user, messages that have been sent to a guild (a subset of members focused on a specific tool/trade, e.g.

Woodworkers), and messages that have been sent to everybody in the Makerspace. Included in the system is an RFID scanner which allows members to swipe in and have the notifications that appear be tailored specifically to them. All things considered, we believe that our system will be effective because it does not require much member effort for them to stay informed.

My STS research centered around the ethical issues involved in the creation and deployment of the Stuxnet virus, which decimated Iranian nuclear enrichment centrifuges in Natanz, Iran in 2010. Specifically, I argued that according to the tenets set forth in St. Thomas Aquinas's Just War Theory, the use of Stuxnet as an act of war *was* indeed justified. Aquinas's Just War Theory requires three tenets to be satisfied for an act of war to be morally permissible: 1) it must be conducted on the authority of the sovereign, 2) it must have a just cause, and 3) it must be conducted with rightful intention. To the first point, my research revealed that there was an abundance of evidence that Iran was using the enriched uranium for nuclear warhead experimentation, so the United States (who are rumored to have had a large hand in creating Stuxnet) acted within its authority as a world power out of fear for its citizens' safety. The second point is similar: because Iran was going to great lengths to hide its uranium-related activity, and because it had *illegally* obtained its centrifuges, there was certainly reason to believe that Iran might continue their pattern of illicit activity once actual warheads were obtained. Finally, the rightful intention is demonstrated through many of the virus's design decisions: it was designed to spread to many, many computers but only to have an effect if the exact configuration present with the systems at Natanz were detected. Because these three tenets were satisfied, Stuxnet's deployment is ethically permissible under Aquinas's Just War Theory.

Working on both of these projects simultaneously was exceedingly valuable. Learning about the technical side of the virus's entry into the system forced me to think at length about

security issues. I brought this mindset over into the technical project, where I advocated for application security in our system. Although Django comes with a high degree of built-in security features, having the security mindset led me to be more scrutinous about possible points of unauthorized entry. In addition, working on the technical project for an entire year led me to appreciate the value of spending a great deal of time and effort on a single project, such as was done with Stuxnet. Experts estimate that the many tens of thousands of lines of complex code that comprised Stuxnet began development in 2005. In summary, working on both of these projects at the same time served not only to enrich each greatly but to also increase my appreciation for computer systems and technical issues.