

**Comparing the Performance of Open-Source Cryptographic Libraries**  
(Technical Topic)

**The “Meme Ban”: Friction between Internet Technologies and Copyright Law**  
(STS Topic)

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 of the Degree  
Bachelor of Science, School of Engineering

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Spring, 2021

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## **Sociotechnical Synthesis**

### (Executive Summary)

Thanks to the development of Internet technologies, people are able to seamlessly interact with each other. Modern business models and human-to-human communication relies on the stability and safety of the Internet to transmit information between users. As Internet-connected technologies become more pervasive, such as in the form of Internet of Things, the need to keep confidential information secure is integral. My technical project analyzes the cryptography libraries and application programming interfaces (APIs) that developers use to provide the security necessary for businesses and individuals to use the Internet without jeopardizing their personal information. My STS research, although not directly related to my technical project, is also inspired from the prevalence of Internet technologies. The STS research takes a close look at the how social media platforms have enabled users to freely share copyrighted materials and the corresponding backlash from rights holders to regain control over their intellectual property.

The technical portion of my thesis found significant performance differences in some of the most popular open-source cryptography APIs available for public use. For developers intending to add security to their applications, there are a multitude of options. Through my capstone project, I studied the several APIs written in the C programming language – OpenSSL, BoringSSL, Libgcrypt, and wolfSSL – to better understand if there are any runtime performance differences that application developers should consider or be mindful of. I found that while OpenSSL is one of the most popular libraries, used heavily in web servers, it is far from a universal library. The results showed that OpenSSL has decent speed results, it is very resource heavy and not ideal for environments that need to maximize efficiency. I found that BoringSSL,

a derivative of OpenSSL, has promising performance statistics over OpenSSL and developers may want to consider it for their projects.

In my STS research, I analyzed the copyright debate over social media distribution of infringing materials. While the Internet has expanded the freedom of speech by allowing users to post content to social media platforms, the theft of intellectual property has increased exponentially. Additionally, digital remix culture, frequently in the form of Internet memes, often contains copyrighted material. I investigated the potential effects of the EU Directive on Copyright in the Digital Single Market to understand the tension between social media companies and rights holders (e.g., authors, publishers, producers). I used analogical imagination to apply copyright issues in the United States and the case of *SABAM v. Netlog* to the potential effects on users. I found that, depending on the enforcement of the directive, content filtering technologies may jeopardize the freedom of speech and digital remix culture that users have grown to enjoy.

Taken together, my STS and technical projects helped me discover the behind-the-scenes work that makes our digital society work smoothly. The technical portion provided a foundational understanding of the technical programming libraries that enable the development of secure applications, while the STS looked into ethical considerations of IP law, Internet speech, and content moderation in the Internet copyright debate. My STS work allowed me to better understand ethical implications of encryption, such as the transfer of illegal information and materials. Finally, my STS and technical project gave me the opportunity to reflect on how much we take the Internet for granted. Cryptography is an essential part of digital security. Everyday use of the Internet to communicate and access information relies on secure and well-vetted cryptographic libraries to ensure that data breaches do not occur. My STS work has helped

me appreciate the free use of social media platforms to upload content. However, this research has helped me to understand that this freedom is not guaranteed.

### **Acknowledgements**

I would like to thank Professor Kathryn Neeley and Professor Richard Jacques for providing flexibility and guidance throughout the thesis process. The thesis and capstone projects were exceptionally challenging during the COVID-19 pandemic, and I am grateful for the assistance I received during my final semesters. I would also like to thank Professor Aaron Bloomfield, Professor John Stankovic, and Professor David Evans for assisting me throughout the capstone process and technical report.