Undergraduate Thesis Prospectus

The Application of Cloud Technology to The Onion Network

(technical research project in Computer Science)

Facebook's Defense: Protecting Reputation Despite a Controversial Business Model

(sociotechnical research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.
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General Research Problem

How can Internet practices better balance convenience and privacy?

Since becoming public in August of 1991, the Internet has simplified communication and information access, transforming economies, education, government, healthcare, and even social interaction (Dentzel, 2020). However, the Internet has also introduced data collection on an unimaginable scale. Almost as an inherent "cost" to Internet usage, users have increasingly less control over the information harvested about them. In return for access, Internet users are the sources of data that are collected and monetized (Matsakis, 2019). On the Internet, convenience and privacy are an elusive balance.

The Application of Cloud Technology to The Onion Network

How can the security of the TOR ("The Onion Router") anonymity network be strengthened to better protect Internet users' privacy and Internet freedom?

The Onion Router (TOR) is a free, worldwide network made up of thousands of volunteer-run servers that allows users to access the Internet anonymously by obfuscating their connection. The Onion Router enables the proliferation of cybercrime such as illegal markets and pedophilia rings (hence giving it the more popular name, "the dark web"); however, in an age of increased Internet censorship, data mining, and surveillance, these systems also grant users with increased security, privacy, and freedom especially in cases of state oppression.

Although the dark web's volunteer-based infrastructure model preserves anonymity through its decentralized nature, it also poses adverse effects on the network's overall performance and security. There are a limited number of volunteer-run relays located worldwide, subject to highly variable network performance depending on the host's location and Internet

Service Provider plan. Relays with limited access to network bandwidth create bottlenecks within onion-routed circuits, negatively affecting the latency of TOR connections (Jones, Arye, Cesareo, & Freedman, 2011). Additionally, the dark web relies on a few well-known entry nodes for onboarding users to the network, which allows for network administrators to easily censor content or block all anonymous traffic by blacklisting all known TOR addresses (Laurikainen, 2010). This is also how authoritarian governments can censor the spread of information amongst and beyond its populations, stifle criticism, and ultimately oppress its citizens.

The sheer scalability and elasticity of services presented by major cloud hosting providers (CHP), such as Amazon Web Services, Microsoft Azure, or Google Cloud, could tremendously enhance TOR's user experience. An experimental implementation and analysis of COR yielded results that exhibit client download times 7.6× faster than TOR (Jones et al, 2011). Another small-scale implementation that utilized dynamically-addressed virtual machine (VM) relays proved to be highly tolerant against denial-of-service attacks, given that CHPs can simply spin up new VM relay instances to handle overwhelming amounts of traffic (Nedeltcheva, Vila, & Marinova, 2019).

Our technical research will utilize existing literature and data to analyze the tradeoffs of different types of cloud compute resources and network configurations and their effect on key metrics. The target metrics will likely include latency, throughput, monetary cost per user, usability, and of course the preservation of security from local and global network adversaries. My team for this endeavor consists of Jack Good, Vineet Kalpathi, and myself; our current plan of attack is to divide the various cloud computational resources amongst ourselves and each to conduct a deep dive into assigned our subject areas. Our group also hopes to conduct small

experiments with small-scale COR circuits to exhibit the benefits of certain AWS resources over others.

With the oversight of professor Ashish Venkat and graduate student Felix Lin from the Department of Computer Science, we aim to conduct a comprehensive investigation which will result in reasonable suggestions towards what kind of computational resources and configurations will yield the highest performance, multi-user capacity, preservation of security, and usability at the lowest cost to the ASP and end users. Our work will result in a technical research paper with prescriptions for optimal COR computing. We sincerely hope that our work will add value to the fairly novel design space of COR, and that once implemented, COR will better defend the Internet freedom and privacy of users over the existing TOR network.

Facebook's Defense: Protecting Reputation Despite a Controversial Business Model

How does Facebook strive to protect its reputation despite its controversial business model?

Since its emergence in February 2004, Facebook has connected more than 2 billion users worldwide while earning record profits through advertising. Throughout Facebook's existence, its reputation has been scrutinized because it uses information it collects to target ads based on audience. The technology giant's business model entails maximizing user time and "engagement" to maximize data collection and monetization. Facebook has also had its fair share of data privacy scandals (TechRepublic, 2020). How has the company's directives and public relations functioned to protect its reputation and satisfy users' demands despite operating in such a way that sparks controversy and criticism in the news?

Although Facebook's company "mission" is to "give people the power to build community and bring the world closer together," as a publicly traded, for-profit corporation this

is a slogan that its public relations department created (Zuckerberg, 2018). Other participants include users of the Facebook and Instagram platforms who seek social connection through the application (Chang, 2018). These users have varying levels of demand for control over their information on the Internet, and the nonprofit organization, the American Civil Liberties Union, is a participant that seeks to restore this control (ACLU, 2018). The Federal Trade Commission is a federal agency that enforces policy to protect consumers' privacy and data security (FTC, 2020). Members of the #StopHateForProfit campaign to boycott Facebook advertising seek to hold Facebook accountable for hate speech and misinformation on the platform and urging them to "prioritize people over profit" (Anti-Defamation League, 2020).

Maréchal, MacKinnon, and Dheere (2020) found that Facebook's algorithms distinguish audiences they call "racist" or "vulnerable to pseudoscience," and target ads to such populations. After the Cambridge Analytica data mining scandal, Hinds (2020) found that users did not delete their accounts or even update their privacy settings after the breach, feeling that they were immune to psychologically tailored advertisements. Dahlberg (2020) notes that this dangerous combination of advertising and user complacency have led critics to blame Facebook for numerous social dysfunctions, among them: hate speech, incitement to violence, viral misinformation and conspiracy theories, "echo chambers," political polarization, and foreign interference in elections.

In July 2020 over 1,200 businesses, including some of the world's biggest brands like Coca-Cola, REI, North Face, Patagonia, LEGO, Dunkin Donuts, and Ben and Jerry's, joined the #StopHateForProfit campaign led by the Anti-Defamation League to boycott Facebook advertising (Aziz, 2020). This was meant to hold Facebook accountable for hate speech and misinformation on the platform, even supported by paid advertising. Facebook responded with

public relations celebrating its quality initiatives. Facebook has come out with a steady drumbeat of promises of reform, committing to cleansing the platform, recently including banning pages that deny the Holocaust, spread the far-right conspiracy theory QAnon, and perpetuate the anti-vaccination rhetoric (Boigon, 2020).

As the 2020 U.S. presidential election approached, given critics' blame of the Facebook and Instagram platforms for the spread of election misinformation and voter suppression content after the 2018 election, Facebook worked to redeem its reputation. To combat this, Facebook explicitly banned misrepresentation of dates, times, locations, methods of voting, voting registration, who is allowed to vote, and whether a vote will be "counted" as well as threats of violence related to voting registration, voting, or the outcome of the election, no matter who posted it. Facebook also introduced a flagging feature that allowed users to flag suspected voting misinformation.

Facebook's Elections Operations Center recruited third-party fact-checking organizations like the Associated Press and PolitiFact to help review suspected misinformation and if debunked, Facebook downranked the content in the platform news feeds and also applied a warning label to the debunked content. Accounts that repeatedly posted misleading content were then downranked on Facebook and made ineligible from appearing on the Instagram Explore page, the page of posts tailored to a specific users' likes (Singh & Blase, 2020). Lastly, Facebook launched the Voting Information Center in August 2020, determined to be "the largest voting information effort in US history," that helped users register to vote and offered guidance on how they could vote.

A 2020 Netflix "documentary-drama hybrid," *The Social Dilemma*, has taken the world by storm. It includes the testimonies of engineers and senior architects at Google, Twitter, and

Facebook sounding the alarm on their creations, harping on issues of mental health, democracy, and discrimination. Rhodes' and Orlowski's (2020) chilling "burn book" movie has the catchphrase: "the technology that connects us also controls us." Facebook promptly published its rebuttal report to the documentary, *What 'The Social Dilemma' Gets Wrong*, a seven-part breakdown of each of the movie's arguments. Facebook (2020) calls the documentary a "conspiracy documentary" that "buries the substance in sensationalism" and relies on commentary of "those who haven't been on the inside for many years."

References

American Civil Liberties Union. (2018, April 10). ACLU Comment on Mark Zuckerberg Senate Testimony. https://www.aclu.org/press-releases/aclu-comment-mark-zuckerberg-senate-testimony

Anti-Defamation League. (2020). Demand Facebook Stop Hate for Profit. https://www.stophateforprofit.org/demand-change

Aziz, A. (2020, June 24). Facebook Ad Boycott Campaign 'Stop Hate For Profit' Gathers Momentum And Scale: Inside The Movement For Change. Forbes. https://www.forbes.com/sites/afdhelaziz/2020/06/24/facebook-ad-boycott-campaign-stop-hate-for-profit-gathers-momentum-and-scale-inside-the-movement-for-change/#6867ad016687

Boigon, M. (2020, October 14). Why is Facebook making so many reforms right now? Not out of altruism, experts say. The Forward. https://forward.com/news/456402/facebook-holocaust-denial-qanon-election-disinformation/

Chang, A. C. (2018, March 26). How Facebook Users Are Responding To The Cambridge Analytica Scandal. NPR Radio. https://www.npr.org/2018/03/26/597100707/how-facebook-users-are-responding-to-the-cambridge-analytica-scandal

Dahlberg, L. (2020). Facebook's Response to Its Democratic Discontents: Quality Initiatives, Ideology and Education's Role. In Stocchetti M. (Ed.), *The Digital Age and Its Discontents: Critical Reflections in Education* (pp. 69-94). Helsinki University Press. doi:10.2307/j.ctv16c9hdw.8

Dentzel, Z. (2020). How the Internet Has Changed Everyday Life. OpenMind. https://www.bbvaopenmind.com/en/articles/internet-changed-everyday-life/#:%7E:text=The%20Internet%20has%20changed%20business,communication%20are%20of%20particular%20significance.&text=The%20Internet%20has%20removed%20all%20communication%20barriers.

Facebook, Inc. (2020, October). What "The Social Dilemma" Gets Wrong. https://about.fb.com/wp-content/uploads/2020/10/What-The-Social-Dilemma-Gets-Wrong.pdf

FTC. (2020, April 28). Federal Trade Commission. FTC Imposes $5 Billion Penalty and Sweeping New Privacy Restrictions [Press release]. https://www.ftc.gov/news-events/press-releases/2019/07/ftc-imposes-5-billion-penalty-sweeping-new-privacy-restrictions

Hinds, J., Williams, E. J., & Joinson, A. N. (2020). "It wouldn't happen to me": Privacy concerns and perspectives following the Cambridge Analytica scandal. *International*

Journal of Human-Computer Studies, *143*, 1–7. https://doi.org/10.1016/j.ijhcs.2020.102498

Jones, N., Arye, M., Cesareo, J., & Freedman, M. (2011). Hiding amongst the clouds: A proposal for cloud-based onion routing. FOCI. Retrieved from https://www.usenix.org/legacy/

Laurikainen, R. (2010). Secure and anonymous communication in the cloud. *Aalto University School of Science and Technology—Department of Computer Science and Engineering, Tech. Rep. TKK-CSE-B10*, 1-5

Maréchal, N., MacKinnon, R., & Dheere, J. (2020). *Getting to the Source of Infodemics: It's the Business Model: A Report from Ranking Digital Rights* (pp. 13-21, Rep.). New America. doi:10.2307/resrep25417.5

Matsakis, L. (2019, February 19). Personal Data Collection: The Complete WIRED Guide. Wired. https://www.wired.com/story/wired-guide-personal-data-collection/

Nedeltcheva, G. N., Vila, E., & Marinova, M. (2019). The onion router: Is the onion network suitable for cloud technologies. *Smart Technologies and Innovation for a Sustainable Future* (pp. 389-398). Springer, Cham.

Rhodes, L. (Producer), & Orlowski, J. (Director). (2020). *The Social Dilemma* [Motion picture]. United States: Exposure Labs

Singh, S., & Blase, M. (2020). *Protecting the Vote: How Internet Platforms Are Addressing Election and Voter Suppression-Related Misinformation and Disinformation* (pp. 15-21, Rep.). New America. doi:10.2307/resrep26363.17

TechRepublic Staff. (2020, July 30). Facebook data privacy scandal: A cheat sheet. TechRepublic. https://www.techrepublic.com/article/facebook-data-privacy-scandal-a-cheat-sheet/

Zuckerberg, M. Z. [@zuck]. (2018, March 21). I want to share an update on the Cambridge Analytica situation -- including the steps we've already taken and our [Facebook Post]. Facebook. https://www.facebook.com/zuck/posts/10104712037900071