Network Provisioning Encryption

Greentech and Mobile Wallets

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By

Ali Ibrahim

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Technical Team Members: N/A

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.

ADVISORS

Sean Ferguson, Department of Engineering and Society

Daniel Graham, Department of Computer Science

Introduction

As mobile payment options become more and more popular, the use of physical currency in the form of cash and coin declines. As this trend continues, societies may inevitably reach a point at which physical money will no longer be used or required and its production will cease. If this point is reached, the sociotechnical imaginary of a futuristic society in which all monetary transactions are done digitally will be ushered in: a cashless society. There are several facets to consider when proposing the idea of a cashless society. I aim to research how digital payment options may usher in a cashless society as well as the benefits, detractions, and different actors' roles in a cashless society. This research question is important because transactions are becoming more and more digitalized as consumers adopt mobile payment wallets, often times without thinking of the cons or the long-term societal implications of their decisions. My research topic is relevant to my work as during the summer of 2021, I interned as a software engineer at a major financial institution. The broader team I was placed on was in charge of creating and maintaining the software that powers mobile payment options such as Apple Pay and Google Pay so that they can be compatible with the financial institution's cards. However, within this broader team, my immediate team had the responsibility of creating an API for the purpose of encrypting payment card information data so that the network could provision a token to the mobile wallet to be used as the card. The project was named Network Provisioning Encryption (NPE).

Technical Topic

This section is a description of the technical work I performed during my Software Engineering internship throughout the summer of 2021. I interned at a major bank on a direct team of three people: the manager who was a senior software engineer as well as two other software engineering interns. The project assigned to the team was called Network Provisioning Encryption. The goal of Network Provisioning Encryption was to function as a backend Application Programming Interface with the purpose of encrypting payment card information data for the purpose of push and pull provisioning for mobile wallets that support debit and credit cards. Push provisioning is the process of "pushing" payment card information data from the bank's app to the mobile wallet app (i.e. Apple Pay, GPay). For obvious reasons, the specifics of the encryption process is confidential and not released to the public therefore, many of the documents the team researched cannot be used as evidence here, however, there is a public document in which Visa explains in more detail the push provisioning concept and also claims that adding cards to mobile wallets results in more spending (and thus more profit) by consumers (Visa in-app provisioning). Pull provisioning is when the customer begins on the third party mobile wallet app to add their card and the payment card information data is "pulled" from the Issuer (The bank). The card networks, Visa and MasterCard, require different encryption schemes for push and pull provisioning. This encryption process is delicate and critical, if it is not performed correctly, the card network will not be able to decrypt the encrypted payload and the card will not be able to be added to the mobile wallet. Although there was

already encryption happening at the financial institution before the project I worked on over the summer, the business logic to encrypt the payment card information was not centralized which made it hard for engineers to make improvements and updates. Furthermore, the previous implementation could have been more efficient. Our goal was essentially to centralize the business logic as well as make the process of encryption more efficient so that the process of adding payment cards to mobile wallets would be easier for customers and use fewer computing resources. This project was important to the bank as mobile wallet adaptation encourages consumers to spend significantly more money (Passy, J) and this project's end goal was to ultimately increase mobile wallet adaptation by making it faster to add a card to a mobile wallet. My personal responsibilities included researching confidential documents regarding the encryption process and requirements, developing a significant portion of the Apple Pay Pull provisioning endpoint, deploying the application to quality assurance, and testing the application.

STS Topic

Although it may not be at the forefront of consumers' minds as they forego cash and instead use Apple Pay, for example, widespread adoption of mobile payment options has led to consumers using less and less cash. If this trend continues, as it seems it will, a new society in which there is zero cash, known as a cashless society, may eventually be ushered in. Many actors have many questions surrounding cashless societies. Naturally, these actors have competing visions as they advocate the benefits and detractions of going

cashless. I aim to analyze these competing visions as I attempt to understand what a cashless society might look like through the sociotechnical imaginaries STS framework.

The widespread adaptation of mobile payment options, and thus a cashless society, rests largely on three major actors: consumers, governments, and private companies. If consumers do not forego cash and adopt digital payment options en masse, then it won't matter if governments and private companies approve. Mobile payment options market themselves as more convenient and secure as well as often times offer perks such as discounts and technology to help track spending, so why are some consumers happy to jump on board while others are reluctant to the idea of only digital payments? More specifically, what are some imaginaries that consumers hold regarding the benefits and negatives of a cashless society. Furthermore, what role do governments and businesses play in supporting or preventing consumers from adopting digital payment options through their own imaginaries (the imaginaries of the government and business).

I'd like to begin through analyzing a situation in which these 3 actors are contending with one another and dissect some of the imaginaries that are present. There are lawsuits, hearings, and bills being signed across several U.S. states regarding whether businesses can stop accepting cash (Selyukh, A). Some government officials in favor of passing bills that make it illegal for a business to not accept cash say that low-income and undocumented consumers have no means of shopping there as they may not have access to smartphones or payment cards. This controversy is an important imaginary: a cashless society might have extremely painful impacts for those who simply don't have the financial or legal

means to use digital payment as they are excluded from participating in society as consumers and could thus result in an economy that is discriminatory and exclusive by nature. Some have theorized that consumers have pushed back on these cashless businesses because of the fear of being tracked by governments, marketers, and financial institutions which poses yet another negative that consumer, governments, and private businesses hold, one which is typically regarded as a negative to the consumer but beneficial to the government and companies: a society in which every transaction, no matter how small, is available to banks, advertisers, governments, etc (Lee, E). However, is this necessarily a bad thing? Although some personal freedom is given up in that there would be no private transactions in a society without physical currency, wouldn't this make it immensely more difficult for individuals who make their money illegally and unethically as those transactions tend to happen in cash as well as tax evasion becoming more difficult? Another interesting point of contention in this lawsuit is that consumers are usually more sensible when paying with cash in terms of how much they spend and what they buy. It's easy to immediately imagine this as a negative: a cashless society results in reckless consumers spending way more money than they should (Bolluyt, J), (Passy, J). However, from the point of the financial institutions and businesses pushing for strictly digital payment, this is a great thing as consumer spending is what drives their profits: a cashless society where consumers think less about spending sounds grim to consumers and but pleasant to businesses and financial institutions. One last important imaginary present in this ongoing clash is that some businesses argue that going cashless will cut down on robberies. Is a cashless society truly synonymous with a society in which there are

significantly less robberies? While it might be easier to steal untraceable cash than forcing the cashier to Venmo you, couldn't thieves just transition to stealing high value items as opposed to currency?

One important imaginary that was not at the forefront of the previously discussed legal battles is the potential of cashless societies reducing waste, specifically by reducing the need and thus quantity of paper and coin currencies. It is estimated that mills produce approximately 400 million tons of paper each year. A lot of the paper that the mills produce is used to produce cash (Ahlers, et al). Unfortunately, as a result, this entire process is a large contributor to deforestation. Additionally, coins are also a huge source of waste. We use over 40,000 tons of metal each year just in the U.S. to mint coins. A cashless society eliminates the need for cash and coins as individuals can transact between themselves (CashApp, Zelle, Venmo, etc) as well as with businesses (ApplePay, GPay, Samsung Pay, etc) without ever touching physical currency. In fact, some fintech companies are actively using the imaginary that cashless society equates to less waste as a marketing point to consumers (Pomelo Pay). While it is true that cashless means we no longer have to produce cash or coin, it doesn't conclusively mean that we've successfully reduced our carbon footprint. Computing power, servers, storage, as well as the production of devices (smartphones, card/mobile payment terminals) also have an impact on the environment to produce and are typically not biodegradable. The question is which of these two options has less of an effect on the environment, and the answer is not yet clear.

Now that many of the imaginaries and controversies surrounding cashless societies have been discussed, a new question needs to be posed, are there any individuals trying to address these controversies through technical or rhetorical means perhaps by introducing untraceable digital currencies or through marketing campaigns?

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Next Steps

- My technical work on the project has concluded as the internship ended but we did not push the API to production. If I were still on the team working on mobile wallets, the next steps would be to add support for GPay, extensively test the API, and then push it to production and inform clients to switch over to it.

- The next steps for my STS research would include investigating the following things:

    - How much of an impact on the physical money supply are mobile wallets actually having, if any.

    - Imaginaries present outside of the lawsuit

    - Investigate how some of the controversies within the imaginaries I discussed are being addressed by consumers, governments, and financial institutions.

    - Investigate trends specifically within the U.S regarding whether the federal reserve plans to produce less cash. The research I've done so far has shown that the federal reserve has largely declined comment on this and similar topics.

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