Undergraduate Thesis Prospectus

ETL System: Bulk Updating Tickets by Creating a Loader Extension

(technical research project in Computer Science)

From Digital Value Medium to Legal Tender: The Implications of the Adoption of Bitcoin as a National Currency

(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 large-scale systems serving diverse users optimize user experience?*

Successful digital systems adapt to meet diverse users' changing needs. In a successful website design, intuitive navigation and useful or engaging content deliver a rewarding user experience (Colman, 2021). In some systems, centralization can serve these ends. In a digital ticketing system, for example, centralization offers advantages to customers who file complaints and to the employees who manage them. A successful system must scale to in response rising demand, and accommodate new processes or techniques as needed.

In the case of a decentralized system such as cryptocurrency, however, such adaptations must ultimately depend not on direct human supervision but on users themselves. For new users, however, cryptocurrency transactions can be difficult to manage. This complication is one of several reasons why efforts in El Salvador to make Bitcoin legal tender have been controversial. Proponents of the idea contend that Bitcoin's practical advantages are worth the difficult adjustment. High-traffic websites, cryptocurrency, and similar digital systems must be scalable, accessible and responsive (Sahoo, 2016), and must offer a rewarding user experience.


**ETL System: Bulk Updating Tickets by Creating a Loader Extension**

*How can a customer service ticketing system efficiently update thousands of tickets?*

This is a solo, capstone project within the Engineering Computer Science department under the advisor, Rosanne Vrugtman. An experience management company's ticketing system had inefficient and time-consuming methods for users to update thousands of tickets. The current techniques that users would follow to implement ticket updates included: excessively sending requests to the public Tickets API or asking developers to create thousands of workflows to

change fields in a ticket. According to the article "Importance of a Ticketing System" (2022), a "well-functioning ticketing system" can help prevent problems from becoming more complex and will keep customers happy when issues are resolved quickly. The project goal is to simplify the process of updating thousands of tickets for a user, which will overall refine a centralized ticketing system and improve customer satisfaction.

The solution to efficiently bulk update tickets was to create a new loader extension into an existing ETL (Extract, Transfer, Load) system, which would handle thousands of requests with a single click. This extension would call the Tickets API at a controlled rate, to reduce the chances of overloading the system. However, making ticket changes through the API instead of the Tickets dashboard would mean certain fields would not be supported. The API only accepts PUT requests for the following fields: changing a ticket's status, priority, owner, score, team, and comment. Users would not be able to update follow-up questions or root causes on a ticket in bulk because of their individualistic, complex schemas. These schemas included nested objects that touched multiple databases, the Tickets API did not have an endpoint that supported these convoluted requests.

An ETL process is designed to extract large amounts of data, transform it to a different format if necessary, and then load that data into a target destination. They must be executed in that exact order because they are all related to each other (Sun & Lan, 2012). Since the company already had components to extract data, my task was to construct a loader extension that will load updated data into the Tickets database. To create this extension, a frontend for the user to interact with must be implemented. This UI was written in Typescript, a React framework. For the backend, a module was coded using the programming language Golang, which handled all the API requests.

To test this loader extension, a workflow must be configured. The workflow begins with an extractor, this will be a spreadsheet that contains all the ticket information, such as the fields and new values that the user wishes to update. The next step in an ETL process would be the transformer, however this step was not needed because the extractor already outputted the data in the desired format for the loader. Therefore, the newly created loader will be the second and last extension added to the workflow. The UI on the loader will show all the ticket fields that will be updated. After initialization, the workflow will run and the output modal will show the number of tickets that were successfully updated and the number that failed. This experiment will be conducted multiple times with varying amounts of tickets to update, from 5 to 60,000 tickets, to see the successful updates rate and execution time of the entire process. Upon completion of this loader extension, bulk updating tickets will no longer be a tedious process, but rather a simple and effective automated job. The company and users who interact with this ticketing system will save a significant amount of time and effort thus increasing customer satisfaction.

**From Digital Value Medium to Legal Tender: The Implications of the Adoption of Bitcoin as a National Currency**

*How do proponents and opponents of making Bitcoin a legal tender in a sovereign nation advance their respective agendas?*

How can a decentralized cryptocurrency become a country's legal tender? Since the introduction of cryptocurrency in 2009, Bitcoin has emerged as the most successful virtual currency in terms of market capitalization and trading volume. For several years, there has been an ongoing debate as to whether Bitcoin can function as a real currency in the same manner that the U.S. dollar or Euro can (Ciaian et al., 2016). The two opposing views include those who have

concerns about Bitcoin's extreme price volatility and proponents who have confidence that it could help countries with emerging markets. On September 7, 2021, El Salvador became the first country to adopt Bitcoin as a legal tender after passing the "Bitcoin Law" (Kshetri, 2022). This law recognized Bitcoin as an official currency to be used for all payments and business transactions within the country. Shortly after, other countries' legislators began looking to pass similar laws, while opposers foreshadowed downfalls for El Salvador's economy.

Participants range from influential policymakers to citizens protesting in the street. At the Bitcoin 2021 conference, President Nayib Bukele of El Salvador stated in a recorded video, "This will generate jobs and help foster financial inclusion for thousands of people outside the formal economy"[1] (Kurmanaev et al., 2021). He believes that making Bitcoin a legal tender will ultimately aid and benefit the lives of Salvadoran citizens. However, Salvadoran protestors marched the streets shortly after the law was passed. They held many powerful signs, such as "No to presidential reelection, no to bitcoin, no to militarization, no to dictatorship"[2] (Villacorta, 2021). Citizens are openly rejecting Bitcoin and additionally displaying their discontent with many decisions President Bukele has made since taking office, the most recent being the approval of Bitcoin. One of the demonstrators stated, "What the government is doing is arrogant, it's authoritarianism"[3] (Villacorta, 2021), since the new law would force businesses to accept Bitcoin as payment. The president hoped that the introduction of Bitcoin would lead to a new era of prosperity for the country, however citizens believe he's acting as a dictator and mainly implemented the law to consolidate his power.

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[1] "Esto generará empleos y ayudará a fomentar la inclusión financiera a miles de personas fuera de la economía formal" (author's translation).

[2] "No a la reelección presidencial, no al bitcoin, no a la militarización, no a la dictadura" (author's translation).

[3] "Lo que está haciendo el Gobierno es arrogante, es autoritarismo" (author's translation).

Participants also include the International Monetary Fund (IMF), which supports economic policies that promote financial stability, financial integrity, and consumer protection. They claim that Bitcoin risks all of those, and are urging Salvadoran authorities to "narrow the scope of the Bitcoin law by removing Bitcoin's legal tender status" (Martin, 2022). Lastly, there is a community on Reddit where Bitcoiners believe their crypto coin is superior to current fiat money, and that El Salvador is only the beginning and more countries will eventually accept Bitcoin (Adventurous, 2022). One user made a post about the limits of fiat money and how Bitcoin can be used as an alternative. They state, "Bitcoin restores a free market in capital accumulation and allocation by removing the power from and reliance upon rentseeking bankers" (solomonsatoshi, 2022). Many Bitcoiners distrust fiat money because of the inflation that occurs when central banks continue to issue more and more of it, which ultimately devalues the USD in one's savings account. However, this cannot occur with Bitcoin because of the strict 21 million limit, thus making their coin inherently more valuable.

Researchers have noted how Bitcoin differs from conventional currencies and whether it has the potential to become a global currency. Chowdhury et al. (2014) state that Bitcoin obtains its value from decentralization and anonymity, which makes it "difficult to manage credit, counterparty, liquidity, market, operational and legal risks." Dabrowski et al. (2018) mention that money must fulfill three criteria: a medium of exchange, a unit of account, and a store of value. Bitcoin's unstable store of value and limited medium of exchange was said to invalidate its chances of being a legal tender. However, McCall (2021) perceives Bitcoin's decentralized nature to be more favorable than the centralized money system. This decentralization eliminates risk when the centralized authority is hacked and reduces time, fees, and human errors since there is no middleman.

Since the adoption of El Salvador's Bitcoin law in September 2021, Bitcoin has lost more than 70% of the value it had in November 2021 due to the recent cryptocurrency crash (Sigalos, 2022). Economic surveys also indicate that this cryptocurrency is still not used by the majority of Salvadoreans. The National Bureau of Economic Research (NBER) conducted a survey and reported that Bitcoin is not being widely used because users "do not understand it, they do not trust it, it is not accepted by businesses, it is very volatile, and it involves high fees" (Renteria, 2022). However, Bitcoiners on Reddit acknowledge the current status of their coin but remain hopeful for future success in El Salvador. User CoinCorner_Sam (2022) comments, "While some "financial experts" have been calling this a failed experiment, they fail to recognise the right of a sovereign country in building its own future. … Future built on math money, a currency that's limited to 21 million and can't be inflated. Rome wasn't built in a day either." Today, proponents and opponents remain set in their values as to whether Bitcoin should be a legal tender or not. As the El Salvador experiment continues, it's evident that one of the factors for its downfalls contributes to the complex user experience that comes with cryptocurrencies.

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