Implementing Blockchain Trading Systems

Replacing the existing market-making model using an open ledger system

F. Adrian Adduci
Department of Computer Science
Columbia University

***Abstract* — The current system of trading securities such as stocks, bonds, commodities, and currencies, has historical roots in a period where individuals had to meet physically to swap goods while lacking a discernable way to trust a party they wished to do business. While we have moved beyond selling stock from underneath a Buttonwood Tree, a system of intermediaries that help spur trading still exists [1]. There are third-parties responsible for confirming ownership an asset, the price for that asset, transferring payments and paying taxes. All of which are carried out dutifully at arms-length and at an added expense for the key parties involved; the buyers and sellers. Further, the incentive for trading securities has always been based on the asymmetric flow of information. One person sells because that person believes they know one thing, while another person buys because they believe they know something different. However, the current system in place has helped obfuscate information and the true price of an asset by decentralizing information and adding an unseen premium to financial transactions. A blockchain based system will remove unnecessary costs caused by intermediaries and create a meaningful flow of information**

I. Introduction

As any person who deals with a bank on a regular basis would recognize, there is a litany of fees and expenses that accumulate while doing business. For an individual or company, these fees are incurred almost exclusively for the movement of funds within or from a financial institution. This Payment Transfer System (PTS) takes many different forms that may be familiar to someone. Automated Clearing House (ACH) is a commonly known system for transferring money between checking accounts. Banknet and VisaNet are standard systems for processing credit card transactions from Master Card and Visa, respectively [2]. All of these payment systems have been built to help facilitate the accounting of money as it moves from one person or entity to another in exchange for goods or services.

Each of these systems also has another standard feature as well; an added (and usually unseen) additional expense of doing business. A typical PTS is a layered system of entities, each with a specific role. None of these entities participate in the market for free, and each charge a percentage of the notional amount being moved for their services. Figure 1 shows an example of a typical debit card PTS.

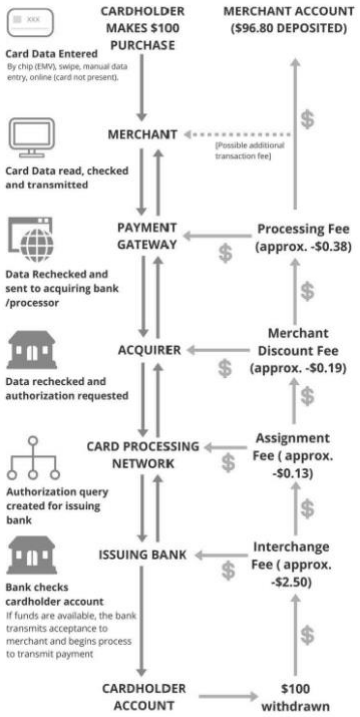

Fig. 1. Illustration of a PTS & Associated Fees [3]

As you may note, the total fees associated with tracking the movement of funds for a purchase accumulate as more parties are brought into a transaction. There is a distinct (and justifiable) linear relationship to the total fees incurred by the buyer and seller and the number of participating third-parties in a transaction. This system is, in effect, a result of needing two individual parties that 'trust' each other to move the funds bilaterally. The farther you need to move the money, the more bilateral bridges you must build, and the more costs are incurred by the end users.

This system extends well beyond the flow of cash for goods and services. A similar dynamic exists in the multi-trillion-dollar market of securities trading. There, beneficiaries such as individuals, pension funds, and municipalities lose an (almost) unquantifiable amount of value to fees and expenses.

II. Describing The Problem Of Stakeholders

The global financial system is big. Really big. You just won't believe how vastly hugely mind-bogglingly big it is. I mean you may think it's a big deal to pay your mortgage each month, but that's just peanuts to the global financial system.

Global equities, the system most commonly thought of as the "stock market" which includes the companies that trade on the New York Stock Exchange, London Stock Exchange and the like, are worth roughly $69 trillion. Bonds, like the savings bonds you received as a kid that matured in fifty years but issued from everyone from the U.S. government to Russian oil companies, are worth roughly $150 trillion. Other debt instruments are worth approximately another $76 trillion globally [4]. Even more esoteric markets like currency exchanges and commodities are almost unfathomable in total size but can see multiple trillions trade in a single day [5].

But for all that money sloshing around, and irrespective of what is being traded, all of these markets have similar operational layers to the PTS that has already been described.

A. *Buyers & Sellers of Securities (i.e. Stakeholders)*

Many people personally invest their money in the market and regularly buy and sell stocks in companies they follow or work for. More so, retirement funds (like pension funds) also regularly invest in different markets. As a result, these are our key stake holders, those actually risking their capital. The goal is to minimize the costs that these stakeholders incur when they transact through third-parties. This saves our stakeholders money, which in the end can be directed to more fruitful endeavors then 'transaction expenses".

Additionally, there may be the added benefit of additional transparency in the market. Often the price of a security is hard to judge given all the different layers of parties involved in a transaction. More information means a better view of price, which also saves our stakeholders value in the long run.

B. *Issuers of Securities (i.e. Stakeholders)*

Typically, when one thinks of an investor, the first picture that comes to mind is a Wall Street trader buying and flipping stocks or bonds. However, those stocks and bonds must come from somewhere or *something*.

That *thing*, are issuers, the source or origination of all the stocks, and bonds, and commodities that are actually exchanged in the market. The issuers can vary dramatically depending on the market. They may be name brand companies like Google or McDonalds in the stock market or municipalities like local governments or schools in the bond market. Whichever the market and whoever the issuer, these stakeholders are all looking to fund and run their operations. An efficient and less costly market for trading means lower expenses and more money to run their day-to-day operations.

C. *Intermediaries (i.e., not a Stakeholder)*

The Intermediaries are the problem we are looking to address. Each market is slightly different in structure and nomenclature, but all are roughly equivalent in form and complexity. Figure 2 illustrates a Security Transfer Model (STM) with the various intermediary parties between our stakeholders.

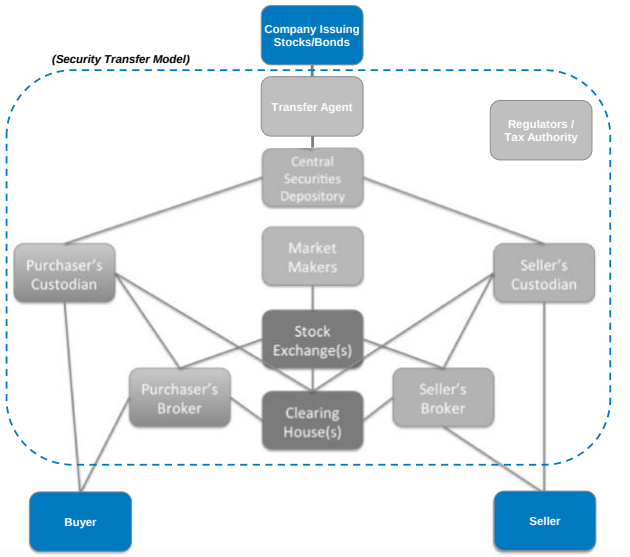

Fig. 2. Illustrative Example Of Parties Involved In Transfer of Securities [6]

As you can observe, there are multiple constituents involved in this process and each charge for the services that they render. For the market makers alone – the investment banks which help initially issue securities for a company – fees for helping issue corporate debt in the U.S. are as high as $125 million per annum, a nearly 1% increase in the cost of debt for an operational function [7].

D. *Incentives to Change*

There are legitimate expenses that are being incurred because of this current system, often daily, by quite literally countless parties to the system. One just needs to look on Bloomberg to see the day's tally of Initial Price Offerings (IPO) on any global stock exchange, or a debt offering from a local hospital to see the fee structures being imposed. These costs are borne because the system that lets companies and individuals access capital and investments dictate them.

Think about that impact. Take a local neighborhood hospital or even the school district that you live in. Each of these municipal functions very likely issue bonds to help them pay for big expenditures every few years such as updating equipment, textbooks, new Emergency Rooms or auditoriums. Each of these illustrative issuers has less money to put towards these causes because of fees incurred by the current system that's in place.

By simplifying the process and removing as many of these third-parties as possible, we can in effect, minimize the amount of overhead inflicted on the market for doing business.

To address this problem in the current system, we must address several operational aspects that intermediaries currently care for. Namely tracking the transfer of securities, accounting for who owns a security at any given time and making the price of that security public for the market.

E. *Available Technology*

There is already an abundance of technology that has been developed as open source solutions to cryptocurrencies.

However, my proposal focuses on one key aspect of the technology, the open-ledger system.

Already there have been 'proof of concept' examples in the news [8] to demonstrate that an open ledger system could be used to track the transfer of actual money and a security-like instrument. The only hurdle is to scale a system to handle to sheer amount of volume the global financial system will utilize and address underlying regulatory issues. Additionally, a separate system for the debating and crediting of actual money may need to be developed, depending on the final system in place. That said, there already countless individuals working on blockchain based systems, and the skill-set, while in demand, is common already and easily learned should demand increase even further.

III. Keys Factors That Must Be Addressed

The logistical issues of tracking ownership of an asset are part of the custodial duties of the intermediaries in the STM. Key issues which need to be addressed include:

A. Tracking Ownership of a Security

A ledger of owners of a security is vital to the system. There must be a record of where a physical security resides and to whom legal rights of ownership are bestowed. More importantly, in order to transfer the asset to another party, a record must be quickly accessible. Today, this feature is shared by many different entities such as clear houses, exchanges broker-dealers. Having a single, clear book of ownership is the first step to replacing the existing system.

B. Changing Ownership of a Security

There must be an easy way to transfer ownership of a security going forward. Today that function is most commonly thought of as residing with a stock exchange, but market-makers and brokers also play an integral role as well. Each currently helps to set a price to buy a security or sell a security (the bid and the ask price and makes their money by creating a difference between the two prices (the bid-ask spread). Different entities have the freedom to set their own spreads, which can create pricing discrepancies across the market – these can also be thought of as inefficiencies. By centralizing a place to make offers to buy and sell a security, these discrepancies can be eliminated.

C. Pricing & Issuing a Security

In addition to tracking the trading of securities, there must an easy way to initially offer the securities to the public. A centralized point of entry, where issues can issue a security (in any legal format they deem fit) must be created.

This system must allow for investors to input the price and terms at which they would be interested in buying a security. Additionally, it must allow for an issuer to aggregate these orders of interest and judge the terms by which they will issue a security to obtain the notional amount of capital they are looking to raise.

IV. Solving For a Simpler System

Figure 3 is an example STM using an open ledger system.

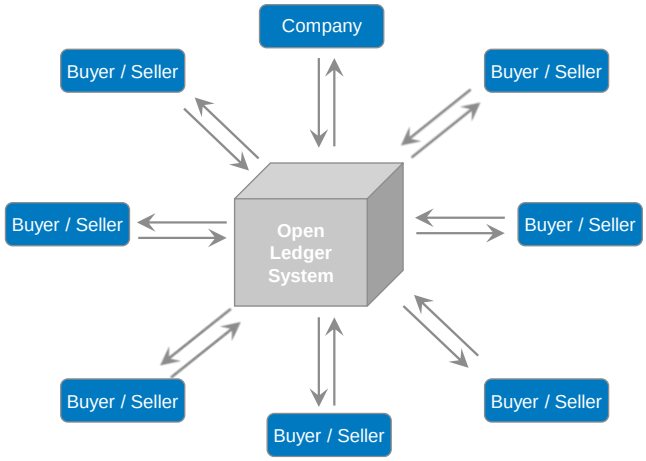

Fig. 3. Illustrative Example Of Parties Involved In Open Ledger STM

A software solution centered around implementing an open ledger, or blockchain, a custodial system would address many, if not all, of the issues that must be addressed. Specifically, blockchain is based on around a share ledger system wherein all of the market participants know the exact ownership structure of the underlying security.

The system would be designed to rely on multiple parties to confirm the key attributes of the security such as bids for the security (buyers), asks for the security (sellers), the current ownership structure (the users) and the keys terms of the security for purposes of understanding the potential price. This would make the available information significantly more transparent then what is currently available in the market today by making the key information not only available to each market participant but also each user responsible for confirming that the information is accurate.

Additionally, a blockchain-based system would allow real-time tracking of transactions and market prices, leading to markedly different cost basis in trading and more efficient operations. This advantage is leveraged from the fact that each individual market participant would have a copy of the key data on their own server (hence the 'open ledger' nomenclature). It's easy to imagine a scenario whereby today, an investor either does not have real-time access to crucial information or cannot provide. This is largely a function that the intermediaries prioritize certain participants based on either economic incentives or regulatory incentives.

Thinking through the individual components, what this system will really be developed on can be summarized as a collection of databases. The architecture should incorporate a system of tracking ownership, potential buyers and seller, and regulatory information. A system to debt and credit real monetary currency (such as U.S. Dollars) and not a cryptocurrency (which is unregulated and not used by any corporation as an operational currency currently) will also be important. Today I assume a normal banking function for the transfer of cash can be run in parallel to my new proposed system, but this could be addressed in the future.

A more detailed system architecture may include each of the specific attributes to be tracked. Figure 4 provides a more detailed look at the potential architecture of the broader system:

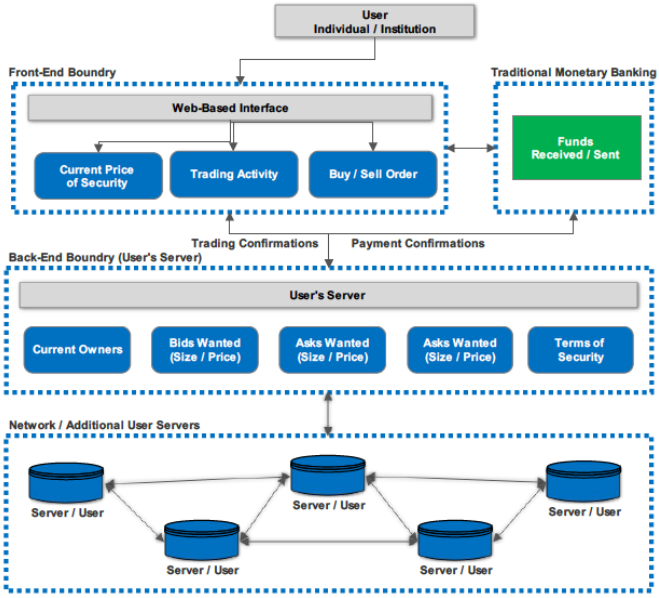

Fig. 4. Potential System Architecture For Open-Ledger Trading System

As you can see, the point of an open ledger system is to decentralize the pool of information and make it available to each individual user. This has the effect of increasing transparency and spreading the administrative burden to the entire network of users.

V. Expected Outcome

The software I propose would implement a system for taking orders to buy and sell securities, track the change in ownership of those securities, and ultimately construct and price new securities. Effectively each part of the proposed user system would replace an intermediary that currently exists as a standalone participant. For example, the part of the system that tracks bids and asks is currently done by an exchange, or the open ledger will track ownership which is currently done by a custodian.

This technology would in practice, replace most of the constituents in the global financial system aside from those who are actually involved as either risk takers of their own capital, or fundraisers looking for money to put to work to run their business. The foundation of this system could be open-source blockchain systems already in existence either through Ethereum [9], Bitcoin [10] or another source which can be forked and used as a basis for creating a contract.

From there, it is really about creating the multitude of contractual features that must be recorded for any security, tracking that security, and allowing it to be traded.

A. *Time to Implement*

The technological aspects of this system should not be difficult to implement. Initial Coin Offerings (ICOs), which utilize an open ledger system as part of their core technology is incredibly prevalent today. Additionally, “faux securities”, or instruments that have terms similar to normal financial instruments like stocks and bonds have also been seen in the market already [11].

As such, the real hurdle will be the timeline of adoption. The financial system is exceptionally well ingrained with the traditional players, and the incentives must be great enough to push for the disruption in the current process. I believe the quantifiable cost savings will require a change in behavior, and the logistics of implementing could take time, especially once you layer in the necessary changes to the regulatory framework

B. *Measuring Success*

Success for this system is inherently quantifiable since we are solving for cost-savings, instead of a more qualitative goal. To measure success, one simply needs to measure the transaction costs currently accrued by market participants and see how much they would compress as a result of implementing an open-ledger system. Additional, secondary goals such as liquidity (trade volume), depth (number of market participants) and transparency (sources of information) are also measurable and can be held up as improvements over the current system.

Lastly, the growth of the market will also be a key consideration. Today, companies need to have a certain size and scale to bear the costs associated with accessing certain pools of capital. Should we see the overall number of institutional participants begin to rise as well, this would be an incredibly important mark of the success of the system, and its ability to open capital up to a broader audience at a lower cost.

VI. Conclusion

Measuring the success of this system is a forthright process. In the end, it will be this factor that ultimately pushes the technology forward. In the current system, there are many, many players with monetary incentives to not implement easier, faster, more open ways of doing business. These are the current intermediaries. That said, the key players in the capital markets, those that have capital, and those that need it, are the ultimate deciders on how a system will operate. They simply need to push for it.

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