8x Protocol

Decentralised recurring payments on the Ethereum blockchain

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May 23, 2018

Abstract

The following paper outlines how the 8x protocol facilitates recurring crypto-currency payments for subscription based revenue model businesses. The Subscription economy is emerging and represents society's transition towards micro-transactions. Blockchain technology would assist with the facilitation of transactions in a decentralised manner. Currently, there are only solutions to accept one-time crypto-currency payments for businesses. 8x is designed to tackle this problem through utilizing Ethereum's decentralised blockchain ledger, the ERC20 token standard, use of stable coins (such as MakerDao) and a network of distributed "service nodes". Subscription plans are registered in a smart contract and customers can subscribe to them directly. To execute the transaction, payments are claimable to a network of "service nodes" who in turn receive a percentage fee of the original subscription payment made between the consumer and vendor. In order for service nodes to make payment claims, the 8x native token must be staked. 8x Protocol makes significant technical advancements and contribution in facilitating the ecosystem for the Subscription Economy.

Contents

1 Introduction

Cryptocurrencies were introduced to the world in 2008 when Satoshi Nakamoto published the Bitcoin whitepaper. The key innovation behind it was the solution to the double spend problem through cryptographic proofs. Bitcoin's first application was the ability to make cross-border payments to individuals globally through a trust-less network of miners. To make a payment, the sender signs the transaction with their private key and broadcasts it to the network. This makes the execution of a crypto-currency payment "push" based as money is transferred from one party to another without any intermediaries.

In a traditional centralised banking system the consumer thinks they're paying a vendor directly. Instead they're actually authorising the vendor to "pull" from their bank account directly.
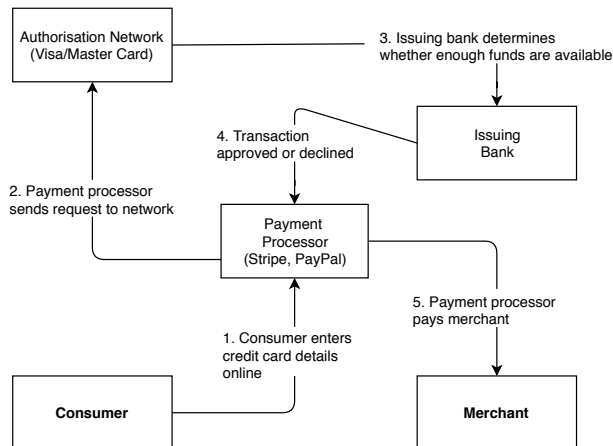

Figure 1: A figure of the existing centralised banking "pull" system. Unless the issuing bank gives approval, the transaction is not made.

There are many benefits of eliminating intermediary parties, the fundamentals of crypto-currency "push" based payments make it difficult to pre-authorise transactions for the purposes of recurring payments. To make a pre-authorised recurring "push" payment system, a party is required to initially trigger the transaction.

A problem of using crypto-currencies for recurring payments is the volatility of the price. For any merchant, whether they prefer to deal in fiat or crypto-currency, paying in a currency like Ether is an inadequate transfer of value due to the volatile nature of the market. Potential solutions to this problem include using 3rd party oracles to retrieve the latest exchange rate, although this places high dependency in external parties. It also introduces a potential threat to the accuracy and reliability of the system to ensure fair exchange rates are used to facilitate the exchange of goods and services.

Date	ETH/USD
First	$
April 2018	396
February 2018	1126
January 2018	747
December 2017	443
November 2017	306
October 2017	301

Table 1: Price of Ether between October 2017 and April 2018

2 The Subscription Economy

2.1 Overview

Initially coined by Zuora, the Subscription Economy represents the idea that customers are happier, subscribing to the outcomes they want, when they want, rather than purchasing a product with the burden of ownership. This change means that traditional companies need to adapt towards a new way of thinking in order to best capitalize on this market. Traditional functions such as pricing, marketing, sales, finance and culture will need to shift to one of value pricing, experience, selling outcomes, customer lifetime value generation, and deep relationships. The new era sees a shift from traditional product focused companies to the emergence of new business models based on deep relationships.

According to Gartner, by 2020 more than 80% of software providers will have shifted to a subscription based model. Further to this, IDC predicts that 50 of the world's largest enterprises will see the majority of their business depend on their ability to create digitally enhanced products, service and experiences. Preparations need to be made on the ecosystem supporting the phenomena of the Subscription Economy in order for it to reach its peak. Studies by Credit Suisse have further shown that within the United States alone, 2015 was a year $420 billion was spent on subscriptions as compared with the year 2000 which say $215 billion. Studies by McKinsey have shown that by 2020, the global payments industry will generate an estimated $2.2 trillion in revenue over $400 billion more than the figure for 2015 ($1.8 trillion) due to an average growth rate of 5 percent. Using these figures, we can observe that in 2015, Subscription services had a market capitalization of 23.3%. There is no accounting for the current growth rate in Subscription Services. It can be safe to assume that the subscription services in the United States alone would account for a market value of $513 billion.
The Subscription Economy is an observed phenomena which is positioned to overtake traditional business models and revolutionize the way value is exchanged on a global scale.

2.2 Challenges Faced

Despite the exponential growth resultant from the phenomena of the Subscription Economy, several challenges and limitations still remain for all stakeholders involved. The facilitation of payments are currently being conducted by centralized third parties placing increased dependency on their services. Further to this, both Enterprise and Customer stakeholders face challenges in managing the end to end business process of facilitating the exchange of value within the Subscription Economy.

From a enterprise perspective, challenges faced are listed below:

1. Dunning management and incident response management
   Dunning management is the the terminology given to requesting payments from customers after their payment expected date. Often, these issues have been caused by simplistic reasons such as the incorrect input of credential details or the expiration of a customer's payment details. However this leads to a loss in productivity and unnecessary disruption to a consumer's experience. The broader business issue is the connection between incident management and subscription services. As a consequence, businesses are left with a disparate customer view which leads to a poor experience.

2. Consolidated customer view
   The Subscription Economy is built on the exchange of trust between an enterprise and customer which has evolved from traditional exchange of product. This is why it is increasingly important for businesses to maintain a consolidated view of their customers in order to provide tailored value. This could be implemented through the use of a customer relationship management system, however the integration between financial systems and being able to provide tailored scenarios remains a challenge.

3. Flexibility of billing, frequency and pricing
   External to the Subscription Economy, the ability to provide customized billing arrangements while being able to change the frequency and pricing configurations on the fly, remains a core challenge. The ability to coordinate tailored payment arrangements on mass will provide significant value to the

Subscription Economy.

4. Security of payment
   With the future view that there will be an abundance of micro-transactions, it is increasingly important to maintain the security and integrity of all payments made.

5. Multi-language and multi-currency support
   The Subscription Economy is still in its infancy. In order to enable a global Subscription Economy, language and currency protocols need to established to facilitate this ecosystem. This will further enable enterprises to reach global audiences and provide value to customers who were initially unable to access their platforms due to language or currency barriers.

From a customer perspective,challenges faced are listed below:

1. Multi-language and multi-currency support The Subscription Economy relies on the removal of barriers whether it be information through language or the exchange of value through different currencies. Existing customers are currently restricted to only those enterprise value providers that accept their local form of currency. This means customers are not able to access the full range of global enterprise value providers on offer.

2. Single view of all subscriptions The future of the Subscription Economy will for-see the rise in subscription based services an individual customer may consume. Existing customers currently face pain points around the management of their subscription services. Other than a debit amount which can be seen within their respective bank accounts, customers will need to access the individual Enterprise value provider in order to check their current status. To prepare for the Subscription Economy, these processes need to be simplified so that effort of both customer and value providers may be directed towards the exchange of value.

3. Incident Response The Subscription Economy signifies the transition of customer behaviours from one of ownership to one of access. If there are any issues which may arise from the customer's ability to access value, their trust and relationship will decline proportionally to the resolution capabilities of the value provider. This applies beyond the Subscription Service and is a challenge traditional business models also face.

2.3 Opportunity for Blockchain

2.3.1 Overview

The subscription economy presents unique opportunities for global challenges to be solved. This includes smart city innovations, news legitimacy, renewable energy, cyber security, global crisis support and access to global education. Within the subscription economy, these issues and challenges present unique challenges and environmental factors which are solved through the use of a blockchain. Within these industries, multiple players exist which places increasing pressure on a centralized solution to manage or coordinate. This is where a blockchain could provide disinter-mediated service in order to provide the trust required. With specific regards to payments within the subscription economy, the advent of a blockchain aims to reduce the % of the transaction cost to the payers. This bears significant ramifications as the Subscription Economy has dependency on micro-transactions to occur. As the Subscription Economy grows, there will be significant increase in transaction volume, frequency and consumers. Existing subscription service payment providers are not positioned to scale well on low volume but high frequency transactions e.g. as a transaction amounts decreases the percentage taken as fees increases exponentially. A blockchain solution to facilitate the recurring exchange in value could provide the necessary ecosystem to enable the subscription economy to society. However, there is currently no open platform for maintaining recurring payments through the blockchain.

2.3.2 Existing Work and Gap

This section aims to explore the history of existing implementations of recurring payments through blockchain and their limitations.

In regards to end-to-end recurring payment solutions, Coinbase Commerce supports recurring payments for merchants. Although it comes with three limitations:

1. Requires users to have a valid Coinbase account with crypto-currency stored on their wallet (for users and businesses).

2. Merchants have to store crypto-currency in their wallets, thus exposing them to the volatility of crypto-currencies.

3. Only supports Bitcoin which is typically slow to transfer and comes with transaction fees compared to currencies such as Ether.

An integral part of 8x's protocol is the use of stable coins such as MakerDao. Using it as medium of transfer of value ensures that businesses and users aren't losing any value due to the volatility of the crypto-currency markets. Due to it's compliance with the ERC20 standard, it can be used to enable "pull" based payments rather than creating a pre-paid subscription escrow smart contract where users deposit their money into at the start of each month. A transfer proxy contract in 8x architecture is able to take the ERC20 tokens directly from the user thus eliminating the need to store them in a single smart contract. The transfer proxy does not contain any business logic.

Part of enabling recurring payments on the blockchain is the repeated execution of a financial transaction between two parties. Recent research into scaling Etheruem has spawned the creation of layer 2 scaling technologies such as state channels. State channels do not consider monthly subscriptions as a way to reduce the burden of one-time payments for subscribers. Creating state channels that require the total subscription up-front may not be economically viable for individuals. It would also eventually require a top-up after the up-front payment is made.

Scheduling tasks on the blockchain remains a challenge. A solution is presented through the Ethereum Alarm Clock (EAC) project by Piper Merriam. With EAC, a smart contract can ask the alarm clock service to schedule a transaction at a particular date and provide a reward to the executor of the scheduled transaction. To prevent execution conflict between an increasing number of parties wanting to earn the reward, a claim system is setup. This requires executors to claim the right to execute the payment and then collect the subsequent reward. The earlier the claim is made, the less the total % of the reward is earned. This develops game dynamics where executors are competing against each other - decreasing the likelihood of claim conflicts. The 8x Protocol aims to facilitate a similar ecosystem where network of users collaborate to execute scheduled transactions.

3 8x Protocol

3.1 Vision

The 8x Protocol envisions itself as the leading standard for managing recurring payments on the blockchain. The convergence of the Subscription Economy and blockchain technology presents unique opportunities and challenges which the 8x Protocol aims to solve. The 8x Protocol strives to transform the world through empowering enterprises and individuals alike to utilize crypto-currencies. This is enabled through the the simplification and facilitation of recurring payments by utilizing stable coins as a reliable transfer of value.

3.2 Technical Overview

Figure 2 below shows the series of steps taken by businesses, consumers and executors in order to facilitate the 8x protocol for decentralized recurring payments.

1. Subscription plan created on 8x charging $10 every 30 days with a 2% transaction fee.

Business

4. 30 days later

Service Nodes are notified or are keeping track that a $10 subscription, with a 2% fee, is due

SN

SN

8x Protocol

5. If the subscription meets a Service Node's criteria*, it will execute the transaction and funds are transferred from the user to the business.

SN

SN

3. Funds pulled directly from user's wallet through ERC20 approve function and paid to business.

SN

User

Wallet:
1 ETH

Wallet:
0 ETH
1 DAI

* Service Node execution criteria includes:
- Does the Service Node have enough staked tokens?
- Does the subscription meet the profit threshold set by the owner?
- How long has it been since a subscription has been claimed by the node?

2. If no DAI, atomic swap from ETH to DAI is done via a decentralised exchange.
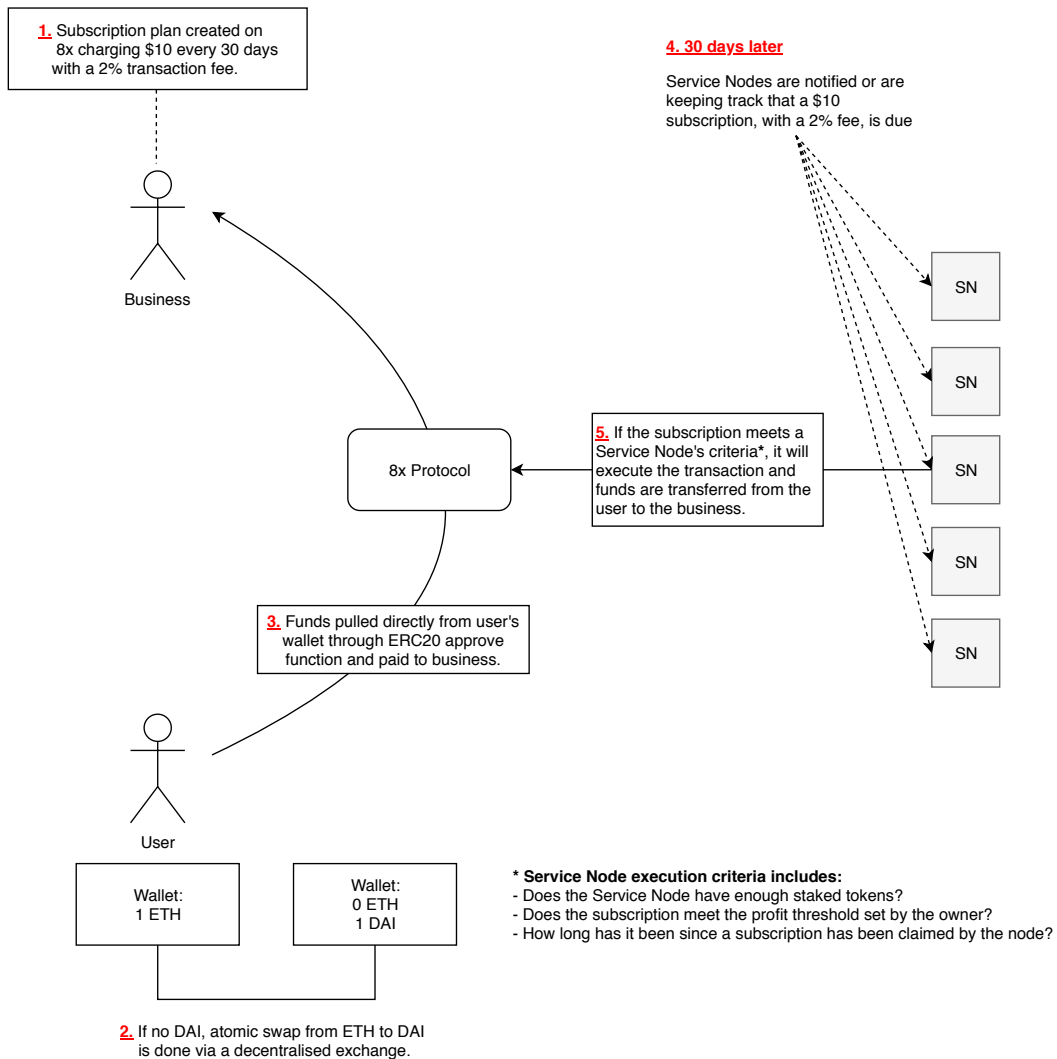
Figure 2: a conceptional diagram of how each party will interact with the 8x protocol

1. Businesses will create a subscription plan specifying the amount (denoted in dollars), frequency and a fee. A dynamic fee allows businesses to specify how important it is for them to receive their payment on time. The higher the fee is set, the faster it will take to to collect payments for the subscriptions as service nodes' incentive is lower in comparison to higher fee subscriptions.

2. Consumers subscribe to a subscription plan created by the business. This is assuming they already have Dai in a wallet. If they don't, a decentralized exchange can be used to facilitate the atomic swap between Ether and Dai. Stable coins ensure no value is lost due to volatility.

3. Service nodes can process a subscription once the payment date is due. Higher payment fees, initially set by the business, will be executed first as service nodes will want to maximize profitability. A service node processing a subscription for the first time will then have that subscription assigned to them in the future. They will also be required to stake tokens proportional to the amount of the subscription they are claiming. This means that service nodes are bounded to how many 8x tokens they have in order to process subscriptions. Failing to execute on an assigned subscription results in a service node's staked 8x tokens to be slashed. This proportional ratio is to be adjusted as the 8x ecosystem matures.

3.3 Token Use Case

8x tokens will be required to be staked when a service node executes a transaction. Once a service node executes a transaction for the first time, they have the right to process that subscription in the future too. It is through this mechanism that service nodes must carefully specify the parameters for executing a subscriptions as low fees can result in capital being locked up inefficiently. Similar analogies can be drawn to Ethereum's concept of gas price and computational power. Transactions paid with a low gas fee are unlikely to be executed quickly due to the more profitable transactions available. However if demand is low and blocks are empty miners will include low gas fee transactions as it's better than having no transactions. Similarly token holders are limited to how much capital they have available to process transactions. As usage on the network increases, the amount of 8x tokens in relation to each subscription value will decrease. A schedule for this token multiplier will be determined once the network is live due to the unpredictability of how the system will play out in reality.

The time taken for a service node to execute a subscription for the first time means they must execute within that time frame in the future as well. Such a mechanism will help to prevent execution conflicts leading to wasted gas.

3.4 Penalty Period

If a subscription fee is set too low or there isn't enough demand to process it, after a certain period of N hours (to be determined), the subscription fee is automatically doubled. This process is repeated until it is eventually profitable enough to be processed by a service node.

3.5 Clarifications

Below are some clarifications that may want to be made to the reader to help understand the scope of the 8x protocol.

1. The protocol is not locked down to any particular stable coin or currency. As long as the token is ERC20 compliant, it can be used with the protocol.

2. Users and businesses do not have any interaction with the 8x token itself. They are only concerned with the currency they are paying in eg. Dai.

3. Service nodes are rewarded in the form of the currency the subscription uses, not 8x. The native 8x token is only used for having the right to process transactions and preventing service nodes from acting maliciously (failing to process a transaction in the future).

4. Gas costs are payed by the consumer resulting in a dynamically marked up price. The subscription fee is payed by the business by taking a cut from the actual transaction. Service nodes should not have to factor standard gas costs into their expected profits.

5. Funds are taken out of the users's wallet not an escrow account. This means a business runs the risk of users not paying for the next billing cycle since there may not be enough funds in their wallet when the payment is to be collected. A higher percentage fee will guarantee that goods and services are not given up without enough funds.

6. It could be argued that Ethereum itself could be used rather than 8x to stake and process transactions. However this fails to take into account that the 8x protocol has its own economy where return on investment for service nodes is dependent on the total supply, circulating supply, token distribution and token price. Using another general currency such as Ether would mean that the dynamics of the system are subject to changes unrelated to the scope of the project (eg. inflation rate of Ether, individuals with large supplies).

3.6   Service Nodes

Similar to Ethereum miners, 8x service nodes have a range of economic strategies they can use to maximise their profits. The figure below uses two extreme values for the subscription fee and the value to help visualise the potential scenarios that could occur. Competition refers to the fact that multiple service nodes may try to execute the same subscription at the same time leading to potentially wasted gas.
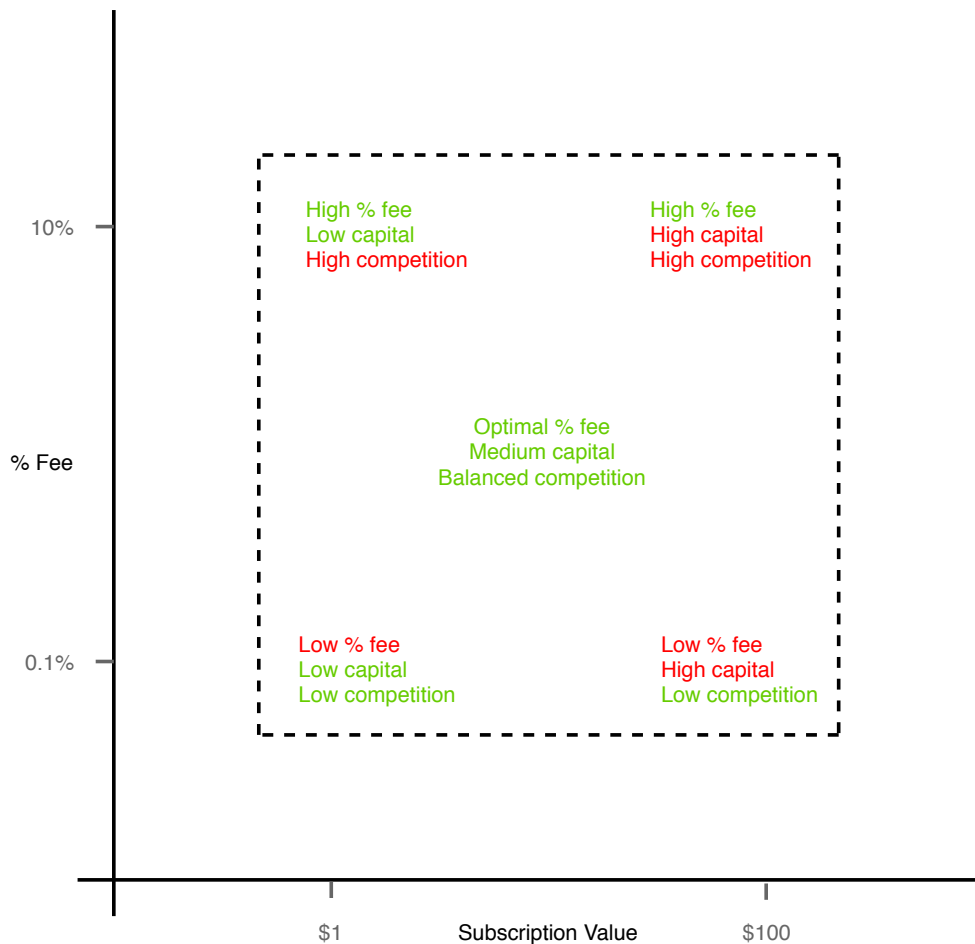
Figure 3: a diagram bounding the possible strategies service nodes can use in the protocol

4 Smart Contracts

4.1 Architecture

The entire protocol is run on the Ethereum blockchain through smart contracts written in Solidity. Standard gas fees applies to interact with the smart contract for businesses, consumers and service nodes. Apart from the transaction fee made during a subscription payment no additional costs are applied. Considerations have been made to ensure expensive operations such as CALL are minimised where possible.
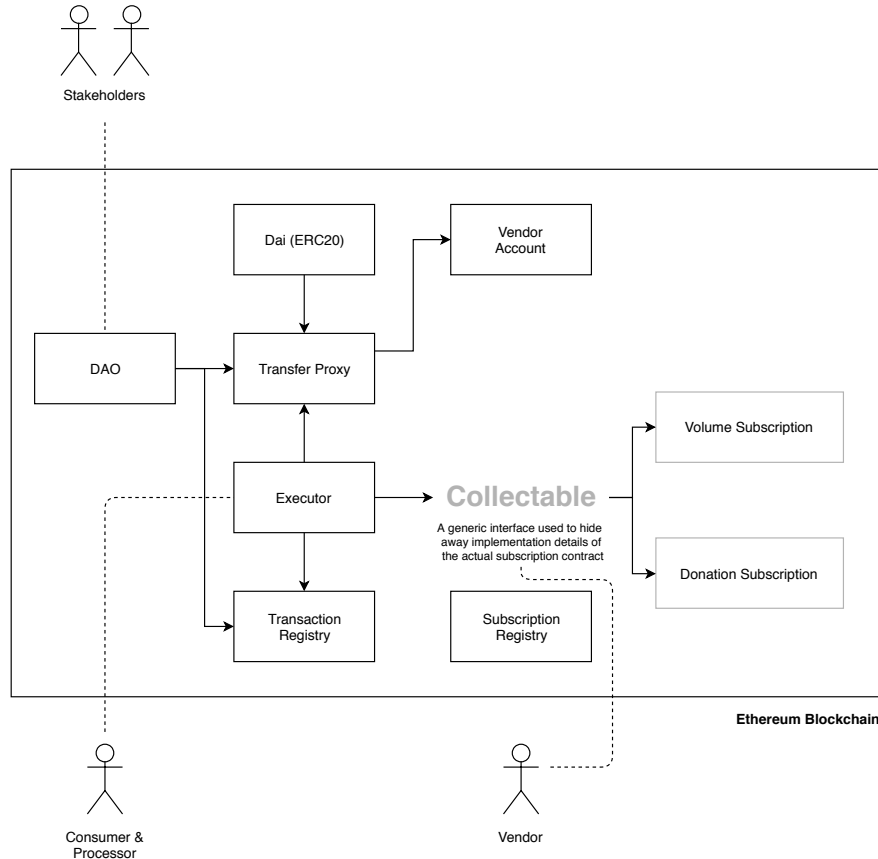

Figure 4: a high level view of how the different smart contracts will interact with each other to create a decentralized payments protocol

4.2 Transfer Proxy

As discussed in the "previous work" section, 0x's model of keeping a transfer proxy is one that has been implemented into this architecture. By having a single component authorised and responsible for taking and making payments we can store the logic for these payments in the executor contract. While the logic for payments should be tied to the information returned from the collectable interface, having a hard coupling could lead to costly immutability down the line. The transfer proxy has an array of authorised addresses which grant access to pull funds from users and pay businesses although this is controlled by a multi-signature wallet with a time lock of 2 weeks to propagate changes. The only exception to the time-lock is to kill the contract to revoke access to user funds in the case of an attack By having multiple authorized addresses, a new executor contract can be deployed and the old one can be deprecated. When the transfer proxy is called, it uses the ERC20 transferFrom() function to send Dai directly from the user's wallet to the merchant.

4.3 Executor

The executor component is where the core logic and functionality of the smart contract lies. Consumers and service nodes interact with it directly in order to claim and make payments. Since all subscription contracts adhere to the collectable interface, the logic for how much money should be charged and whether the subscription is valid is in the actual subscription contract. The executor simply interacts with the exposed public methods. The only extra power the executor has is to cancel a user's subscription in the case that they don't have enough funds. When a user subscribes to a subscription, the executor calls the transfer proxy to facilitate the transaction and adds the payment to the transaction registry.

4.4 Transaction Registry

Once the first payment is made by the consumer (when they subscribe), the transaction is added to the transaction registry which creates a data object for the next payment. When a service node processes a subscription for the first time, the subscription is then assigned to them for future payments too.

4.5 Collectable

Initial plans for the architecture included a separate subscription contract and plan contract for businesses and consumers to interact with. Although this kind of rigidity runs into problems quickly when something like a donation subscription contract needs to be implemented as the user is in full control of how much they want to give. For this reason a more general purpose architecture has been made which facilitates the addition of new subscription contracts as long as they adhere to the interface. Currently the interface methods include:

1. Check whether the subscription is valid

2. Get the subscription owner's balance

3. Return how much the subscriber owes from their subscription

4. Terminate the subscription if they don't have enough funds

If a user doesn't have enough Dai to pay for their subscriptions, an email will be sent to them to remind them to top up. These email details and reminders are to be hosted on a centralised server due to the unwanted nature of publicly exposing an email address to public key on the blockchain.

4.6 Subscription Registry

Crypto-currencies aim to provide power back into the hands of the people. The subscription registry allows users to view all the services they're currently subscribed to through mappings stored in the contract. This therefore allows them to view currently subscribed services, when the next payment is due and cancel any unwanted subscriptions. Credit card payment subscriptions can only be monitored once consumers see money paid out in their bank statements. To cancel authorisation, consumers need to find the "Cancel Subscription" button on a vendor's website.

5 Platform

5.1 Existing Players in the Subscription Economy

8x Protocol acknowledges that there are numerous existing payment providers within the current subscription economy. They are not limited to the following:

1. Zuora

2. Recurly

3. Stripe

4. Chanify

5. Braintreepayments

6. Changebee

7. Paysimple

8. Monexa

9. 2checkout

10. Moonclerk

Crypto-currency payment integration capabilities are still yet to be confirmed for public usage with these payment providers. The 8x Protocol team have begun pioneering a subscription based crypto-currency payments platform designed to be industry standard. Existing payment providers carry legacy systems and may not pivot as efficiently as 8x Protocol in advancing their systems to support the new platform. Existing payment providers also have more incentive to partner with the 8x Protocol so that they are able to leverage new capabilities to satisfy their existing customer base.

5.2 Ecosystem

The 8x Protocol envisions itself to be the market leader in providing recurring cyptocurrency payment services in a reliable and simple manner. 8x Protocol prides itself on providing lower costs per transaction than existing players while providing a holistic solution for both Enterprise and customers. The current price per transaction is captured at 1% transaction fee. However this is subject to change as the platform advances and the ecosystem matures. The 8x Protocol provides a unique value proposition for all stakeholders whether they are individual consumers or enterprise level entities.The following provides an overview of 8x Protocol's potential. Further details of functionality are to be relased at a later date as the 8x Protocol matures.

For customers:

1. Intuitive front end user interface to simplistically manage all subscription services on offer.

2. Raise concerns or issues with subscription service providers in a simplistic and efficient manner.

For businesses:

1. Integration into existing enterprise resource planning and customer relationship management systems for holistic management of sales.

2. Additional tools to adjust pricing models and resolve customer queries in a simplistic manner.

5.3   Token Economy

Several tokenomic models have been considered during the design of the 8x Protocol ecosystem. With the goal of facilitating a distributed autonomous ecosystem, the 8x Protocol token economy can be classified into three distinct user types each with their own unique attributes.

1. Business - An entity which provides goods and services. Businesses are able to establish a percentage fee for processing the transaction to service nodes. The higher the fee on offer, the more attractive and faster a payment is processed.

2. User - An entity which provides payment for receiving value from a business.

3. Service Node Operator - Individuals on the 8x Protocol whom process the payment from business to user. Service node operators are subject to game theory through a dynamically changing fee structure for processing payments. Once a service node operator processes a payment, the nominated 8x token amount is staked as part of the process - reducing overall circulating supply. After processing a transaction, the percentage fee of the transaction volume, established by the Business is paid to the service node operator. This incentives service node operators to continue processing transactions as part of the 8x Protocol.

6 Future Improvements

6.1 Support for other Stable Coins

The existing solution utilises MakerDao to hedge against crypto-currency volatility. However, the 8x protocol may further support alternate stable coins (in compliance to ERC20 standard) to reduce risk as MakerDao is only collateralised by a single asset class. Having the option to use other stable coins with different collaterilisation allocations and other international pegs will provide additional stability and versatility to the protocol. For example, international businesses have to rely on the USD to their currency's exchange rate. If a stable coin is created that allows them to eliminate this additional uncertainty it can provide significant advantages to the existing fiat system. Support for additional currencies can easily be implemented through specifying the token type in the subscription contract.

6.2 Global Fiat settling layer

Stable coins such as Dai are viewed as a representation of value in comparison to the US dollar. While this may be acceptable for crypto-currency products, fiat-based businesses would want to receive fiat payments directly in their bank accounts. This is due to the complexities of understanding crypto-currencies, having to deal with private keys and being KYC/AML compliant. An application which utilizes the 8x protocol to provide a streamlined business experience for payments will have a competitive edge over Stripe and Paypal as it costs much less. It will also help improve the utilities of crypto-currencies as a whole.

6.3 User Interface

The front end application layer of the 8x Protocol is constantly evolving. It intends to solve the challenges listed in section 2.2 of this paper. 8x Protocol plans to provide a simplified user interface to improve the challenges of the processes associated with the Subscription Economy. The protocol intends to focus on the primary payments mechanism initially. Further details regarding its future state user interface will be released at a later date.

6.4 Integration with Enterprise Resource Planning Apps

8x protocol intends to be the leading global recurring crypto-currency payments provider for all value providers. This includes enterprises and as such 8x Protocol will be considering enterprise partnerships and integration opportunities with leading enterprise software providers. The intent is to enable enterprise value providers to reduce effort on back-end payments facilitation and more towards value deliver to customers. Details of this will be expanded as the 8x Protocol matures.

6.5 Regulation and Regulators

8x Protocol acknowledges the establishment of existing governing financial bodies of countries around the world. 8x intends to comply with global financial governing law. 8x protocol intends to provide awareness and facilitate positive working relationships between itself and regulatory bodies to ensure the proper policies are followed when establishing the ecosystem for the Subscription Economy.

6.6 White-listed Service Node Operators

Considerations have been made so that future state of the 8x ecosystem may enable businesses to also becoming service node operators. This will function through businesses white listing their own processors to reduce costs. However businesses would also have to be willing to incur any technical risks with interfacing with the 8x protocol.

6.7 Dynamic Stake Multiplier

As service node operators prepare to process a transaction, an amount of 8x tokens need to be staked as part of the 8x Protocol ecosystem. This amount staked is proportional to the transaction amount. In order to maintain the 8x Protocol economy, this multiplier will be dynamically adjusted in the future in order to cater for different conditions. For now it will be a constant that can be statically set.

6.8   Dynamic Gas Cost Calculator

Currently, the cost to execute a transaction (including the gas required for service nodes to execute) is calculated manually based on gas price * gas used. In the future 8x aims to make this mechanism dynamic so user's pay for exactly how much is needed.

7 Summary

Why: To be the leading enablers of the Subscription Economy in the crypto-currency space.

What Enabling recurring payments in crypto-currency.

How:

1. Use of stable coins such as MakerDao eliminates risk of crypto-currency volatility when purchasing goods and services.

2. Letting users stay in control of their funds eliminates the risk of high risk attack vectors.

3. Allowing a network of competitive service nodes to execute payments and earn a percentage of the fee ensures transactions are always executed.

4. Creation of SDKs can allow dApps and regular web apps to accept recurring crypto-currency payments.

5. Single interface for users to manage all their recurring subscriptions.

6. Loosely coupled smart contract architecture allows easy protocol improvement.

8 Glossary

8.1 MakerDao

Unlike centralised stable coins such as Tether, MakerDao is fully collateralised (by Ether) and maintains a 1:1 ratio to USD. MakerDao achieves this through collateralised debt positions (CDPs) backed by their Ether. As the price of Ether goes up, CDP holders can borrow more Dai. Should the value of Ether go below a 100% collateralisation ratio to Dai, CDPs are liquidated and Ether is returned back to the owners of the CDP. In the case of a black swan event (flash crash of Ether's price), MakerDao's second token, Maker/MKR, is liquidated on the open market to raise additional capital to maintain the collateral. While Dai has temporarily lost it's peg to USD in the past, the target rate set by MKR holders ensures that the peg is quickly restored.

8.2 State Channels

The concept behind state channels is to open a "bar tab" like account on-chain and let both parties transact until they want to close the engagement and settle their account. In the case of any fraudulent transactions, a user can submit cryptographic proofs that the other party cheated or attempted to cheat and get their money back.

9   Acknowledgements

This solution is built upon the many foundation steps taken by projects such as MakerDao, Ethereum Alarm Clock Service, 0x, Kyber Network and more. Innovation is a continuous process and I hope that this work can be further used to help the world realise a decentralised future where all subscription services can be paid on the blockchain.

10 References

[1] Bloomberg. *The Ether Thief*. URL: https://www.bloomberg.com/features/2017-the-ether-thief/.

[2] Brandon Chez. *Coinmarketcap*. URL: https://coinmarketcap.com/.

[3] Chronaeon. *A rewrite of the Yellowpaper in non-Yellowpaper syntax*. URL: https://github.com/chronaeon/beigepaper.

[4] Fred Ehrsam. *How to Raise Money on a Blockchain with a Token*. URL: https://blog.gdax.com/how-to-raise-money-on-a-blockchain-with-a-token-510562c9cdfa.

[5] *Eth Gas Station*. URL: https://ethgasstation.info/.

[6] Eric Hughes. *A Cypherpunk's Manifesto*. URL: https://www.activism.net/cypherpunk/manifesto.html.

[7] Yaron Velner Loi Luu. *KyberNetwork - A trustless decentralized exchange and payment service*. URL: https://home.kyber.network/assets/KyberNetworkWhitepaper.pdf.

[8] Piper Merriam. *Ethereum Alarm Clock*. URL: https://github.com/ethereum-alarm-clock/ethereum-alarm-clock.

[9] Joel Monegro. *Fat Protocols*. URL: http://www.usv.com/blog/fat-protocols.

[10] Satoshi Nakamoto. *Bitcoin: A Peer-to-Peer Electronic Cash System*. URL: https://bitcoin.org/bitcoin.pdf.

[11] Owocki. *Recurring Subscription Models are a Good Thing and should be viable on Ethereum (Merit + Architecture ERC)*. URL: https://github.com/ethereum/EIPs/issues/948.

[12] Ptrwtts. *Pooled Payments (scaling solution for one-to-many transactions)*. URL: https://ethresear.ch/t/pooled-payments-scaling-solution-for-one-to-many-transactions/590.

[13] Molly Richardson. *Challenges for Cryptocurrency Subscription Billing*. URL: https://www.rebilly.com/challenges-for-cryptocurrency-subscription-billing/.

[14] Bancard Sales. *How Credit Card Processing Works - Transaction Cycle 2 Pricing Models*. URL: https://www.youtube.com/watch?v=avRkRuQsZ6M.

[15] Kyle Samani. *New Models For Utility Tokens*. URL: https://multicoin.capital/2018/02/13/new-models-utility-tokens/.

[16] Jayne Scuncio. *6 subscription economy solutions for global challenges in 2018*. URL: https://www.zuora.com/2018/02/02/6-subscription-economy-solutions-for-global-challenges-in-2018/.

[17] Myles Snider. *An Overview of Stablecoins*. URL: https://multicoin.capital/2018/01/17/an-overview-of-stablecoins/.

[18] John Stark. *Making Sense of Ethereum's Layer 2 Scaling Solutions: State Channels, Plasma, and Truebit*. URL: https://medium.com/l4-media/making-sense-of-ethereums-layer-2-scaling-solutions-state-channels-plasma-and-truebit-22cb40dcc2f4.

[19] Jack Tanner. *Summary of Ethereum Upgradeable Smart Contract RD*. URL: https://blog.indorse.io/ethereum-upgradeable-smart-contract-strategies-456350d0557c.

[20] Maker Team. *The Dai Stablcoin System*. URL: https://makerdao.com/whitepaper/DaiDec17WP.pdf.

[21] Tien Tzuo. *The Subscription Economy*. URL: https://www.zuora.com/vision/subscription-economy/.

[22] Will Warren. *The difference between App Coins and Protocol Tokens*. URL: https://blog.0xproject.com/the-difference-between-app-coins-and-protocol-tokens-7281a428348c.

[23] Amir Bandeali Will Warren. *0x: An open protocol for decentralized exchange on the Ethereum blockchain*. URL: https://github.com/0xProject/whitepaper.

[24] Dr. Gavin Wood. *Ethereum: A Secure Decentralised Generalised Transaction Ledger*. URL: https://github.com/ethereum/yellowpaper.

[25] Dr. Gavin Wood. *Poladot: Vision For A Heterogeneous Multi-Chain Framework*. URL: https://github.com/polkadot-io/polkadot-white-paper.