Cross Ledger Protocol
Connect the World

Proof-of-Support
A Hybrid Delegated Proof-of-Stake Consensus

Creating a smarter economy through the blockchain

Thesis Beginning – Operating A Smarter Decentralized Economy

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Abstract. "Providing a single online platform that will give a worldwide audience access to educate themselves through a library of compiled knowledge through a decentralized educational support system by rewarding those whom help others via Cross Ledger. This decentralized platform will also allow those same users the ability to utilize the tools provided to access a full-spectrum of cryptocurrency payment and peer-to-peer services that allow a connection to the world. With the focus being education, the world as we know it struggles for a true decentralization of education with there being more than $1 trillion in student loan debt just in the United States[1] with low-income students that cannot afford 95% of college tuitions[2]. Creating a global system where payments are given back to the people, rather than paid to a centralized system, we create what we call the Smarter Economy. We want to create the future of online education by making programs accredited one day with no tuition requirement where contributors and participants are recognized by a social economy giving incentivized reasons to learn and self-educate each other to promote global growth of innovation and knowledge. Creating Blockchain University[3] to allow a decentralized ledger of blockchain knowledge to be shared through incentives under a hybrid reward system called Proof-of-Support. We achieve to solve one of the longest issues worldwide of a broken educational system by providing a full spectrum of education and financial services to enable us to position our mission into success.

1　Issues

In the traditional educational system, there are billions of people who struggle with the ability to advance in these centralized systems. With more than $1 trillion in total outstanding student loan debt[4] this goes to show how problematic the worldwide student loan debt issues are. In some areas in the world. such as Denmark, only 2% of the population can afford college tuition. The benchmark of individuals affording the ability to go to college is becoming historically high. Education has become more expensive as the years have passed, reaching all-time highs of dollars required for a standard education system. It is estimated that the cost will continue to rise, which will adversely affect the number of individuals who can't achieve education due to financial reasons. In the age when the explosion of the dot-coms has led to a massive protocol-enabling tool used to connect data from billions of individuals worldwide, we are facing more than 2 billion of those same individuals not having access to a method of banking.[5] One methodology designed to help create a connected world was Bitcoin. The world of cryptocurrency started from Bitcoin creator Satoshi Nakamoto, whose whitepaper[6] formulated a mission of creating a decentralized world free of intermediaries with a peer-to-peer electronic cash system.[7] Since then, the world of digital currency has exploded to be worth more than $400 billion. But there is a lack of accurate, legitimate

[1] https://yaleglobal.yale.edu/content/student-debt-rising-worldwide
[2] https://www.nasfaa.org/news-item/11623/
[3] https://bu.org
[4] https://yaleglobal.yale.edu/content/student-debt-rising-worldwide
[5] http://www.worldbank.org/en/programs/globalfindex
[6] https://bitcoin.org/bitcoin.pdf
[7] https://www.nonprofitcollegesonline.com/global-tuition/

resources to grasp an understanding of what this entails and what the benefits of becoming part of it are. We cannot rely on a single location for vital information to help educate one another.

2   About Us

Spend Foundation[8] was formed to design a decentralized educational platform based on the need to help connect millions of unbanked people around the world acquire accurate financial and blockchain information for free and give them the financial tools needed to help push towards the modernization of a decentralized ecosystem of products. The Spend Foundation aims to create the world's first fully tuition free decentralized online university.

3   Solution

Cross Ledger is powered by open-source blockchain technology that can be seen in Steem and EOS and compiled by Spend Foundations hybrid version of Delegated Proof-of-Stake[9] called Proof-of-Support which will be explained later in this paper. Cross Ledger's main platform purpose will be comprised of allowing a decentralized blockchain based learning ecosystem operate that has been designed for users to get full information on the educational purposes of Distributed Ledger Technology (i.e. blockchain), Digital Currency (i.e. cryptocurrency, Bitcoin), and to understand the full-spectrum of everything around this new era of technology. This online university will be built with previous and current data, analytics, and information to help educate users about the benefits and risks of blockchain and cryptocurrencies. This will also allow users to educate and answer questions while rewarding one another through a decentralized education system.

Spend Foundation also utilizes Cross Ledger to provide a product suite containing financial blockchain tools such as a wallet that supports multiple blockchain assets connecting all of them to an off-chain multitude layered distributed ledger with high-transactional process to help facilitate rapid transfers within the network and ecosystem[10]

4   Blockchain University – Decentralized Education

The Spend Foundation is creating an online eUniversity running off of Cross Ledger designed as a core location for billions of users worldwide where they can benefit from accurate, beneficial knowledge about blockchain technology and cryptocurrencies. There will also be a decentralized database designed for peer-to-peer education and rewards based on helping educate each other. The platform will contain an encyclopedia of knowledge compiled from open-source, web analysis, user contribution, and overall market data information available.

Users will be able to access this knowledge base for free. Blockchain University will never charge its users for access to its platform. We encourage higher learning and have designed the Proof-of-Support reward system to benefit those whom want to help others learn and achieve. Those whom answer questions posted by users in the Learning Center will be rewarded based on upvotes of relevance to their answer on the problem/question asked by the member.

[8] https://spend.foundation
[9] https://steemit.com/dpos/@dantheman/dpos-consensus-algorithm-this-missing-white-paper
[10] https://xledger.network

Blockchain University will offer intuitive cryptocurrency education course for beginners, intermediate, and experts with certifications. As part of the Spend Foundation "Blockchain Learning Initiative" the foundation will sponsor an Education Tour which will visit cities all over the world to promote education in this Fourth Industrial Revolution. Our goal is to launch an accredited program one day through partnerships and/or sponsorships with governed educational institutions.

An overwhelming majority of cryptocurrencies are uninterested in generating value outside of their own networks. Cross Ledger is an outlier in this realm, both generating a knowledge base and encouraging its users to share and contribute to its content. Most cryptocurrencies generate little value for those who are not actively using the network. Cross Ledger, by contrast, generates content and encourages users to share and use it. The information is then indexed by major search engines and viewed by large number of passive users. Those users in turn generate organic advertising for Blockchain University.

Ask any writer, blogger, or photographer about how many times they've seen their original content used illegally online, and the answer is probably in the hundreds. And once it spreads virally through social media, forget about it. As things are reposted and retweeted, the original author becomes a distant memory. But if social media became based in the blockchain, every content creator could easily point to the public ledger and timestamp showing when exactly the content was created and uploaded to the Internet. Whether or not this would matter to the legions who take content and repost it without second thought is debatable, but anyone attempting to profit off said content was have a major fight on their hands, particularly if blockchain-based attribution began receiving support from governments and courts of law. With Blockchain University focused on content creation, it refers to its content creators as 'first-class citizens' - the blockchain can validate originality among the BU community.

5 Cross Ledger's Spendcoin (SPND)

The native currency that operates the Cross Ledger Network will be Spendcoin with a symbol of SPND. SPND will serve as a utility coin throughout the network and outside the network it will act as a digital currency used for transactional purposes. Within our ecosystem SPND can be used to access premium wallet tools and used towards fees of the ecosystem and network. Block Rewards and User Support Rewards will all be facilitated in the basis of SPND. Outside the network SPND can be transacted as a means of value.

Spendcoins will not be offered in a token sale or ICO. The purpose of Spendcoins was not to raise capital to build a product or an idea. Spendcoin is the basis of the application and our mission is to create an open-source free system that the world can use. Therefore, Spendcoins will be distributed to users worldwide for free through a various set of promotions and distribution phases that will be detailed online.

SPND will have an inflation period that will be reduced from 10% to 1% over a 20-year emission period. For all of the criticism of Bitcoin in its first decade of life, its inflation rate was in triple digits for the first two years; above 30% for the first five years, and above 10% for the first eight years.[11] We wanted to create an inflation rate that works coherently with the network to allow a fixed period where expectation of inflation is reasonable. We followed the Steem model for this inflation as there has been a proven track record this this method. With that being said, there will be a 75% distribution to Proof-of-Support consensus, 15% to stakers, and 10% to block producers.

Spendcoin is able to hold on the value of the sum of its users' parts, such as answers,

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[11] https://bitcointalk.org/index.php?topic=130619.0

comments, and votes. Its users are constantly curating content at no charge. The trick then is determining which user contributions are bringing value to a network and which are just 'white noise.'

Monetizing the creation of support content will create a new open educational platform. When creators post to other social media sites, that form a link back to Blockchain University, it is possible to monetize said content based on the number of shares or votes it receives in the BU community. Being paid via the blockchain avoids the middle man interaction and theoretically, should, increase the efficiency at which payments are made.

Cross Ledger tries to break down this invisible barrier by paying anyone willing to do simple tasks with the purpose of distributing its Spendcoins. The more users there are in cryptocurrency, the more useful it becomes. Thus, the more people who can get involved without the steep learning curve, the more successful the network can be.

6 Cross Ledger Protocol

Proof of Support a Hybrid Delegated Proof-of-Stake Consensus Model

The Spend Foundation believes in creating as close of an all-around blockchain to efficiently use all of the benefits that the underlying technology is able to conceive by combining the tools of three blockchain consensuses. With the help of Ethereum's Framework[12] Steems DPoS[13], and EOS Dawn dApp System[14], we are able to co-create a cross blockchain ledger by a decentralized system to provide a wealth of knowledge and self-education with a self-governance system without the needs of an intermediary government educational system. With adhered cryptographic governance, we will ensure a vested global ecosystem with overall longevity while Cross Ledger continues to reward users for utilization of the system.

By creating a multiple model blockchain ledger, Cross Ledger maintains the benefits of overcoming the excessive need for electricity usage that Ethereum and Bitcoin use under a proof-of-work mining consensus originally created by Satoishi Nakoamoto[15] to launch a protocol that works on a self-governing system with the mining working on a hybrid Staking method called Proof-of-Support. Cross Ledger was designed to address the major hurdles to adoption and monetization of crypto graphical algorithms under multiple cross-consensus models in which the network aims to achieve distributed consensus by utilizing a hybrid version of Delegated Proof-of-Stake with a two-tier network. Economic incentives with cryptocurrencies allow the peer-to-peer network to facilitate growth of the Cross Ledger.

7 Consensus Algorithm (DPOS)

Cross Ledger Protocol software utilizes the only decentralized consensus algorithm capable of meeting the performance requirements of applications on the blockchain, Delegated Proof of Stake (DPOS) and many parts of this white paper's consensus model is cited from EOSIO's White Paper to understand the core of Cross Ledger. Under this algorithm, those who hold tokens on a blockchain adopting the Cross Ledger software may select block producers through a continuous approval voting system. Anyone may choose to participate in block production and will be given an opportunity to produce blocks proportional to the total votes they have received relative to all other producers. For private blockchains, the management could use the tokens to add or remove staff.

[12] https://www.ethereum.org
[13] www.github.com/eosio/
[14] https://steem.io/SteemWhitePaper.pdf
[15] https://bitcoin.org/bitcoin.pdf

The Cross Ledger software enables blocks to be produced exactly every 3 seconds. Exactly one producer is authorized to produce a block at any given point in time. If the block is not produced at the scheduled time, then the block for that time slot is skipped. When one or more blocks are skipped, there is a 6-or-more second gap in the blockchain.

Using Cross Ledger, software blocks are produced in rounds of 21. At the start of each round, 21 unique block producers are chosen. The top 20 by total approval are automatically chosen every round and the last producer is chosen proportional to its number of votes relative to other producers. The selected producers are shuffled using a pseudorandom number derived from the block time. This shuffling is done to ensure that all producers maintain balanced connectivity to all other producers.

If a producer misses a block and has not produced any blocks within the last 24 hours, they are removed from consideration until they notify the blockchain of their intention to start producing blocks again. This ensures the network operates smoothly by minimizing the number of blocks missed by not scheduling those who are proven to be unreliable.

Under normal conditions, a DPOS blockchain does not experience any forks because the block producers cooperate to produce blocks rather than compete against one another. In the event there is a fork, consensus will automatically switch to the longest chain. This metric works because the rate at which blocks are added to a blockchain fork is directly correlated to the percentage of block producers that share the same consensus. In other words, a blockchain fork with more producers on it will grow in length faster than one with fewer producers. Furthermore, no block producer should be producing blocks on two forks at the same time. If a block producer is caught doing this, said block producer will likely be voted out. Cryptographic evidence of such double-production may also be used to automatically remove abusers.

8   Social Consensus Algorithm (POS)

Proof-of-Support (POS) has a fundamental solution which allows the users of the network to provide assistance and support to each other in a decentralized manner where the data is stored permanently on the blockchain, allowing for simple, transparent solutions among all users.

The fundamental unit and native currency of the on the network is SPND(Spendcoin), a cryptocurrency. Blockchain University Self-Support Reward platform operates on the basis of upvotes and downvotes to the response of the solution given to the party looking for support. Under this model, individuals whom have supported and contributed the most to the decentralized platform, as measured by their account balance, have the greatest influence over how contributions are calculated. Furthermore, Blockchain University only allows members to upvote/downvote with a SPND balance.

When creating an ecosystem where one is recognized for their support and help, it continues to motivate a legitimate growth of the community through the spread of knowledge and education. The platform is designed to enable effective payments in cryptocurrency be distributed for all accurate support given. Users no longer have to choose to pay someone from their own account; instead they are able to Upvote or Downvote support content to determine the individual reward.[16] The Support Voting System (SVS) derives from the network community and voting required to accurately distribute payments to support contributors. Voting is essentially a method of contribution and generates rewards on its own, allowing both the supporter/contributor and voter a proportional reward based on the final reward paid to the supporter/contributor.

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[16] https://steem.io/SteemWhitePaper.pdf

9   Transaction Confirmation

The typical DPOS blockchain has a block producer participation level of 100%. Each transaction is confirmed to 99.9% certainty from the time of broadcast in just 1.5 seconds. There are outliers to this degree of accuracy, however. They include bugs in the software, heaviest than expected Internet traffic, or occasions when malicious block producers attempt to exploit the system by creating two or more forks. Therefore, it takes confirmation by 15 of the 21 block producers (71.4%) to absolutely confirm a transaction as complete and irreversible. For the typical configuration of the Cross Ledger software, this will take approximately 45 seconds in a normal environment. Once 15 of 21 producers have confirmed the transaction, it will not switch to a different fork that excludes this block, regardless of the fork length.

Users can be warned by a node that they are likely on a minority fork within 9 seconds of the fork's creation. Statistically speaking, being on two consecutive missed forks suggests a 95% probability that node resides on a minority fork. If the number increases to three consecutive missed forks, the probability rises to 99%. Should users choose, they can generate a predictive model that can collect data on nodes missed and recent participation rates, combined with other relevant data to inform producers of any errors in their process. User reaction to these warnings is at their discretion depending on their reasons behind the production. The only sure-fire way to confirm their production is faulty is to wait for the 15 producers to confirm said transaction.

10   Accounts

The process of creating an account is simple. You do it by using the Cross Ledger software. Each account is referenced with an original name chosen by the account creator. The name must be no less than 2 characters in length and no more than 32. Each account supports namespaces, meaning, if you are the owner of Hello@Moon.com, you are the only person who can create an account @Hello.Moon.Com. The only other requirement for registration is that each account has to be supplied with the minimal account balance at the time it is created. This amount is designated for paying the price of storing the user's account data.

The cost of funding a new blockchain account is decidedly less than the cost of acquiring a few customers in the traditional business sense. In our decentralized model, application developers pay the cost to sign up a new user.

11   Creation of Accounts

Implementing the aforementioned algorithm that limits bandwidth based on existing rate of use is made easier when used in conjunction with transparent account balances; an accounting system made famous by Steem. In this format, any account that fails to maintain the minimum required balance for a weekly transaction will not be allowed to make said transaction. It is necessary for at least 21 of 32 accounts to hold the minimum balance in order to properly verify a transaction. Users are able to engage in smaller transactions, but must do so from a balance larger than the minimum. There are risks in creating a low-balance account when usage is low on the network. If network usage increases while the account is still in a low-balance state, it may be locked until such time as more funds are added or the usage drops back to the lower level. To avoid this scenario, it is suggested that new accounts be created with funds matching 10-fold the minimum account required to perform a weekly transaction. With that level of funding, even if demand were to rise 10x, the account would remain active.

To achieve this amount, users must fund their own account, the minimum balance cannot be achieved from token creation. Doing so exposes the system to the threat of Sybil attacks, where a user attempts to create several accounts at once in order to gain a larger degree of influence.

12 Justification of Minimum Balances

The idea of a minimum account balance should be viewed as an incentive, not a detriment. People intent on being active participants in the network will naturally maintain a minimum balance.[17] One of the most basic concepts of owning a business is the fundamental knowledge that every user brings a unique, significant value to the business. Businesses can spend up to $200 to acquire a user - either by paying them directly, paying for advertising, or even paying to purchase another company to consume its existing user base. New users are often given access to special services or unique offers to keep them engaged with the business. Businesses do this in order to monetize the user further through straight sales or indirect streams of revenue. Enterprise blockchain Ripple employs a minimum balance of $0.15.[18] It scales the minimum requirement higher for account resources as they are used. This algorithm estimates a minimum balance of $0.10 for a user to make at least one transaction per week. Requiring a minimum balance for new users allows the blockchain to keep a minimum value on each user. If a business wants to bring a new customer to the blockchain, pre-funding the minimum balance will allow the customer to come in and instantly be able to start making transactions. By charging a larger sum - say $1.00 for new users - a platform can engage new customers to vet the network to ensure that the quality and long-term forecast of the blockchain lives up to the expectations.

13 Value is in the Content

Links are quite literally what holds both the Internet, and the things we hold valuable on it, together. The connections between websites allow Google's algorithms to point you in the best direction when you want to remodel your home, plan a trip to Disney World, or play fantasy football. When people vote on content in a social network setting, they fortify the bond between themselves and the content. The more connections a network has, the more valuable its information is perceived as being. The curation of content is an overwhelmingly important industry in connecting buyers and sellers. The Cross Ledger network rewards users through Spendcoins when they are accurate responders of new support questions. The Cross Ledger network can then use algorithms to extract the most accurate content from what would otherwise be a nonstop deluge of data.

14 Scripts & Virtual Machines

A centerpiece of the Cross Ledger software is its ability to intuitively and accurately send authenticated messages to all accounts at the same time. This is done through a combination of virtual machines and powerful scripting language. Both of these technical aspects are independent of the Cross Ledger suite and rely on different technologies. Any other virtual machines or scripting tools that you might wish to use can be easily integrated into the Cross Ledger software API.

Schema Defined Messages

All messages sent between accounts in a Cross Ledger software blockchain are defined by a schema that is part of the blockchain's consensus. The schema allows error-free conversations between JSON and binary.

Schema Defined Database

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[17] http://www.forbes.com/sites/tristanlouis/2013/08/31/how-much-is-a-us

[18] https://ripple.com/build/reserves/

Similar to the messages is a schema-defined database that contains all application data in an easily-interpreted format (JSON). The data is all stored/manipulated in binary.

Separating Authentication from Application

Parallelization in blockchain practices is important for a number of reasons, including keeping the computational debt of a network as low as possible. To keep the system from needing to implement its regeneration application as much as possible, Cross Ledger's software contains three sections of validation logic:

- Validating that a message is internally consistent.

- Validating that all preconditions are valid.

- Modifying the application state.

Internal consistency is the easiest part of this process, and both it and validating preconditions can be done with maximum parallelism as they are read-only processes. If the application state of a transaction needs to be modified, it is a slower process requiring write access.

To verify that a message can be applied, it must be authenticated in a read-only process. Calculations must be performed, although once it has joined the block, these calculations are no longer necessary.

Virtual Machine Independent Architecture

Cross Ledger's software-based blockchain is in the business of multiple virtual machines and believes they can be supported by more virtual machines as time goes on. This is why this whitepaper does not make mention of specific languages or machines. At present, two virtual machines are being evaluated for use with Cross Ledger software-based blockchains.

Web Assembly (WASM)

The benefit of Web Assembly (WASM) is that it can enable contracts in familiar languages such as C or C++ and a majority of the industry supports it. It is a web standard designed for high-performance web applications. A similar version is being developed by Ethereum (Ethereum flavored Web Assembly (WASM). The Ethereum method can be easily made compatible with Cross Ledger's software.

15   Merkle Proofs for Light Client Validation (LCV)

The goal of Light Client Validation (LCV) is to ferment lightweight proof of existence that can be deemed valid with the tracking of a lightweight data set. For blockchains, the goal necessitates proof that a single transaction is part of a particular block, and in turn that this block is part of the verified history of a blockchain.

Integrating multiple blockchains can get slowed down if all of them must verify every transaction every time. A better solution would be utilizing Merkle proofs of deposit rather than sift through all the block producers. It would also benefit the block producers by cutting down on their overhead while joining forces with another blockchain.

Industry leader Bitcoin, assuming all nodes have access to the full history of block headers, supports the validation of transactions which equals around 4MB of block headers/year. That puts a valid proof at around 512 bytes at the rate of 10 transactions per second.

It's a good match for blockchains with 10-minute block intervals, but not so much for those with 3-second block intervals.

Cross Ledger software utilizes lightweight proofs to prove the existence of any transaction with a proof less than 1,024. Assuming the validated nodes keep up on the previous day's block headers would prove these transactions are less than half the size of Bitcoin's at 200 bytes each.

Validating proofs on other chains sees a wide variety of time/space/bandwidth combinations. There are various pros and cons for tracking all block headers (keeps proof sizes small); tracking only recent headers (minimal long-term storage and proof size).

When it comes time to validate proofs on other chains there are a wide variety of time/space/ bandwidth optimizations that can be made. The specific approach used by each network will likely depend on the percentage of foreign blocks. Once trust has been established, the answer might be for one chain to possess the entire history of a second chain to eliminate the need for proofs. Minimizing inter-chain proofs is a great way to increase productivity and eliminate wasted space and power.

16   Deterministic Parallel Execution of Applications

Blockchain consensus thrives when there is parallel execution of reproducible behavior. This means that as transactions are written to the parallel blocks, they cannot be altered or changed in any way.

Obstacles to this form of execution include mutexes, which allow multiple program threads to take turns sharing access to the same file, and locks, which attempt to enforce limits on access to a resource.

Without the locks in place, there must be some other process to ensure all accounts read and write only to their own private databases. All messages must be written sequentially and in parallel with all other accounts.

When using Cross Ledger software for blockchain purposes, the block producer has the responsibility of ensuring each message is delivered to all threads so that it can be evaluated in parallel. Block producers should utilize algorithms to ensure parallel delivery. Part of this execution necessitates that the message is not delivered immediately, but rather in the next cycle. The reasoning behind this is that the intended receiver may be in the process of modifying its own state in another thread.

Minimizing Communication Latency

Latency is a silent killer in all forms of digital communication. Latency is the time it takes a message to travel from one account to another, and receive a response back in return. This is a major concern of cloud computing solutions when they are located a considerable distance from the computer attempting to access them. Cross Ledger software divides each block into cycles, which are further divided into threads, transactions, and messages to be delivered.

Read-Only Message Handlers

Some Cross Ledger based accounts can be modified to accept or deny messages without needing to write over the account. This occurs on a pass/fail message determined by if the message is permission verified and read-only message handlers are the only handles for a particular account.

Atomic Transactions with Multiple Accounts

Atomic transactions are irreducible and indivisible, meaning they cannot be broken up into smaller portions. It's a technical way of labeling them as all-or-nothing transactions. On occasion, users wish messages to be delivered to and accepted by multiple accounts atomically. To achieve this, both messages are placed in the same transaction. Both accounts are then assigned to the same thread and the messages are applied in order. Sometimes it is desirable to ensure that messages are delivered to and accepted by multiple accounts atomically. In this case both messages are placed in one transaction and both accounts will be assigned the same thread and the messages applied sequentially. In order to maximize performance and minimize cost, atomic transactions should involve 2+ accounts that are already being used frequently.

Partial Evaluation of Blockchain State

All components must be modular in nature for scaling up to work with blockchain technology

Cross Ledger software for blockchain allows subsets of applications to be upgraded without running everything at the same time. For instance, if an app developer is upgrading how it displays its exchange rate, it has no need to rewrite its social media applications.

Subjective Best Effort Scheduling

It is the responsibility of each block producer utilizing Cross Ledger software to determine the computations and time required to successfully process a transaction, regardless if the transaction is produced by a user or delivered automatically by a script.

At a network level when the Cross Ledger software is in use, all transactions on a launched blockchain will have a fixed computational bandwidth. Each block producer is able to develop his or her own algorithm for these resources. If the block producer comes to the determination that a transaction has used too much of the computational capacity, they can reject it when they produce their own block. However, each user will still process said transaction if it is found to be valid by a majority of the other producers.

If a producer creates a block featuring transactions whose computational capacity falls outside the range of acceptability, the next producer in line might reject it. If that happens, the next producer becomes the de facto tie breaker.

There is no set rule for how long something will take to run on the blockchain because of this individual subjectivity among producers. This allows individuals the chance to optimize their own processes without fearing a breach of consensus

17 Governance

Governance requires the actual power of humans; algorithms can't solve this equation. Governance is how people deal with subjective matters. Cross Ledger software's blockchain setup has a governance process that block producers can implement to guide themselves through the process by electing block producers from the legion of coin holders. The block producers must approve any changes to the blockchain. Producers have additional powers such as, freezing accounts and updating defective applications.

However, they are not omnipotent. If they refuse to make changes wished by the token holders, they can be voted out of their block producer positions. If they attempt to make changes without the permission of the token holders, said changes will be rejected by a third entity, non-producing validators within the system.

Although tensions can run high between block producers and token holders, the lack of governance is usually far worse. Blockchains rely on informal, spur of the moment decisions that have unpredictable and often unwelcome results.

Messages & Handlers

Inter-account messaging is achieved in the Cross Ledger software and scripts can be used to handle how said messages are sent and received. Each account registered with Cross Ledger software has its own exclusive database accessible only to its own designated message handlers. The combination of these handlers and the messaging system forms Cross Ledger's smart contracts.

Role-Based Permission Management

Permission management is Cross Ledger's terminology for determining if a message has the proper authorization. Over time, and with repeated use, this process becomes standard. The most important component of security in this format is multi-user control. When used correctly, it minimizes hackers' ability to steal from the blockchain environment. Each account in Cross Ledger is controlled by private keys and the specific order of other accounts in the block.

These keys can be used to determine how a message is sent from one account to another. If one user wishes to contact another by direct message on Twitter, he can implement a key to activate his Twitter account to communicate to another user once the cryptocurrency price reaches a certain level.

Named Permissions Levels

In Cross Ledger software's terminology, permission levels are given from individual accounts, with each representing a level of authority.

Each authority level consists of keys and/or other accounts' permission levels that define what actions that authority level is capable of. Each authority level has multiple signatures as safeguards against illicit use.

A similar structure is found in the Steem blockchain. In Steem, there are three permission levels hard-coded into the blockchain:

- Owner

- Active

- Posting

The Owner permission level is the master key of an account. This level operates in cold storage and can perform any task. Active permissions can do anything except change who the Owner is. Posting permissions are releated to social functions such as posting or voting. The Cross Ledger model takes this premise and allows each user to define its own levels of permission.

Named Message Handler Groups

Cross Ledger account holders can create their own message handlers within names or nested groups. Other accounts can use those message handlers to perform tasks if they have configured their permission levels for this function.

In Cross Ledger, the message handler groups range from the account name (highest) to individual message types (lowest). Thus, an individual message could be seen as: **@accountname.group1.subgroup2.MessageType3**.

These various levels of handlers allow individuals to draw up complex actions such as creating group orders, making deposits, or canceling orders.

Permission Mapping

Permission mapping allows account holders to build bridges between their own named Permission Levels and any other Named Message Handler Group. This allows users the ability to give some level of permission or control to friends. To continue on the example from above, User X can map a permission for User Y to post on User X's Twitter account. When this mapping is complete, User Y can post a message for User X on Twitter, but User Y would still need her own keys to sign said message. This is beneficial because it allows the original user to see which friend is using which permission and for what purpose.

Evaluating Permissions

Before any action is permitted, a logical, progressive series of checks is done in Cross Ledger software to ensure its validity.

For example, the system delivers an Action message from @Moon to @Sun. The Cross Ledger software will follow a specific order of checks.

1) Cross Ledger will see if @Moon has defined a permission mapping for @Sun.group1.subgroup2.Action.

2) If there is no permission mapping, Cross Ledger will check for a mapping for @Sun.group1.subgroup2, then @Sun.group1, then @Sun.

3) If no permission mapping is found, the mapping will be assigned to @Moon.now.

4) When the mapping is identified, the next step is the validation of signing authority which uses both the authority associated with said permission and a threshold multi-signature process.

5) Each time the mapping fails to find authentication it travels further up the original line, ultimately reaching @Moon.now

Default Permission Groups

There are two default permission groups for each account using Cross Ledger technology. They are:

- Owner - capable of performing any task

- Active - capable of performing any task except changing the owner of the group

- All other permission groups are created from inside the Active group.

Parallel Evaluation of Permissions

Changes to permissions that affect transactions will not take effect until the end of a block. All keys and permission evaluations for all transitions happen as parallel processes, as this is a read-only process. Transaction permissions can be evaluated and updated as pending transactions are entering a network, meaning they don't have to be re-evaluated when the transactions are executed. Because of the inherent nature of needing permissions to verify transactions, the permission verification process manifests a large part of a network's computation power. Changing this process to be read-only allows things to progress much more quickly, enhancing the productivity of bandwidth and computational power.

Furthermore, if a transaction is verified in one block, it does not have to be re-verified along the blockchain. This step can be skipped based on the fact that it passed the verification process in a single block. This step can lower the computational power being used by the blockchain as a whole.

Mandatory Delay Messages

A key factor in battling illicit activity in blockchains is time management. Theft of private keys is a dangerous threat to blockchain security, and as such Cross Ledger has built-in safeguards against it.

Based on the applications in use, Cross Ledger allows developers to create mandates dictating that certain actions must undergo a waiting period before becoming a permanent part of the block. When the action is activated, Cross Ledger enables a message sent to the account owner, generally in the form of a text or email. If a private key has been stolen or a user's information has been otherwise compromised, they can use this opportunity to cancel the action before it is finalized. They can also use Cross Ledger's account recovery operations to recover their account and develop a new private key.

The waiting time will vary from developer to developer, as well as by, what sort of action is being taken. Anything financial will have a longer wait time to ensure validity.

Stolen Key Recovery

If users become aware or suspect that their private keys have been stolen, Cross Ledger has a built-in function to restore control of their account. Every owner designates an account recovery partner when creating said account. The owner can use any owner key active in the prior 30 days along with accepted protocol from the account recovery partner to reset the owner key on their account. This is a double failsafe system. Neither the owner nor the account recovery partner can reset control of the account without the other party.

The specifics of the recovery plan dissuade hackers or criminals from trying to exploit it, since they need the other person on the account to do so.

The recovery process is much simpler than a multi-signature arrangement, such as those used in some of the blockchain's transactions. Although a representative will assist in the account recovery process, the only two entities that need to be part of it are the account owner and an account recovery partner. This simplification downgrades costs and potential legal interaction.

Freezing Accounts

No system is ever 100% failsafe. Occasionally a smart contract will fail, or a new exploit will emerge that unfairly delivers additional resources to an undeserving party. The block producers have the power and the responsibility to find solutions to these issues. They may freeze accounts if they feel something is amiss. In Cross Ledger software, a 17-of-21 vote by active producers can freeze an account. If token owners believe producers are using this power incorrectly, they can vote the producers out and unfreeze the account.

Changing Account Code

If freezing an account does not fix a situation, the elected block producers can replace the account's code with a 17-of-21 vote. Using the Cross Ledger software allows the block producers to perform this procedure without hard forking the blockchain as a whole.

Constitution

Another feature of the Cross Ledger software is the ability for blockchain users to sign a 'constitution', which is a written terms of service agreement dictating how peer-to-peer transactions will be established and maintained. Blockchain users are required to sign it as it defines their obligations during peer-to-peer transactions. There will be established rules as well as dispute resolution standards and mutually accepted rules. Once the constitution is established, all future messages must include the constitution's hash as part of its signature. The constitution also must differentiate between bugs in the code that produce actual errors and malicious attempts.

Upgrading the Protocol & Constitution

Cross Ledger's software has a seven-step process that must be completed before a blockchain's source code or constitution can be updated. Those seven steps include:

- Block producers propose a change to the constitution and obtain 17-of-21 approval.

- Block producers maintain 17-of-21 approval for 30 consecutive days.

- All users are required to sign transactions using the hash of the new constitution.
- Block producers adopt changes to the source code that reflect the change in the constitution and propose it to the blockchain using the hash of a git commit.
- Block producers maintain 17-of-21 approval for 30 consecutive days.
- Changes to the code take effect 7 days later, giving all full nodes one week to upgrade after ratification of the source code.
- All nodes that do not upgrade to the new code shut down automatically.

The default setting included in the Cross Ledger software requires 2-3 months to update the blockchain with new features. If, however, the updates are to fix non-critical errors and do not affect the constitution, the wait time can drop to 1-2 months.

Emergency Changes

Block producers have the power to push the process along quickly if the necessary change reflects a fundamental or dangerous flaw in a security situation. In this scenario, the block producers can push through a software change, although some constitutions forbid it.

18 Conclusion

The Cross Ledger Blockchain is in its infancy stage. As time progresses there will be new features added to improve the protocol and software. As many can understand at this point this platform is very Steem and EOS oriented as we highly believe in these platforms whom have a proven track record. We have applied key elements, forked code, and new social consensus methods to create solutions that apply for Blockchain University and the Spend Platform. Let's create a smarter decentralized economy through blockchains.