

PAR

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PAR - Productive Asset Record System

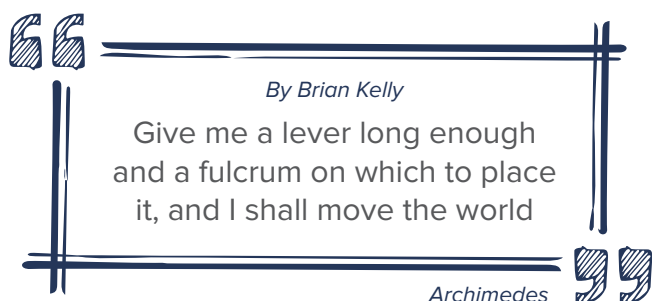
An open investment recording system built with intelligent lending and hedge fund administration in mind. A first of its kind, a fully transparent administration and audit platform leveraging blockchain technology.

Brian Kelly, George Samman, Michael Sofaer, Jacob Dienelt

9.1.2016

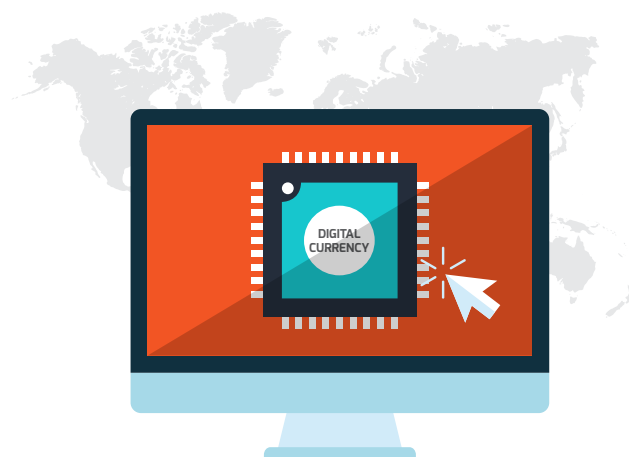
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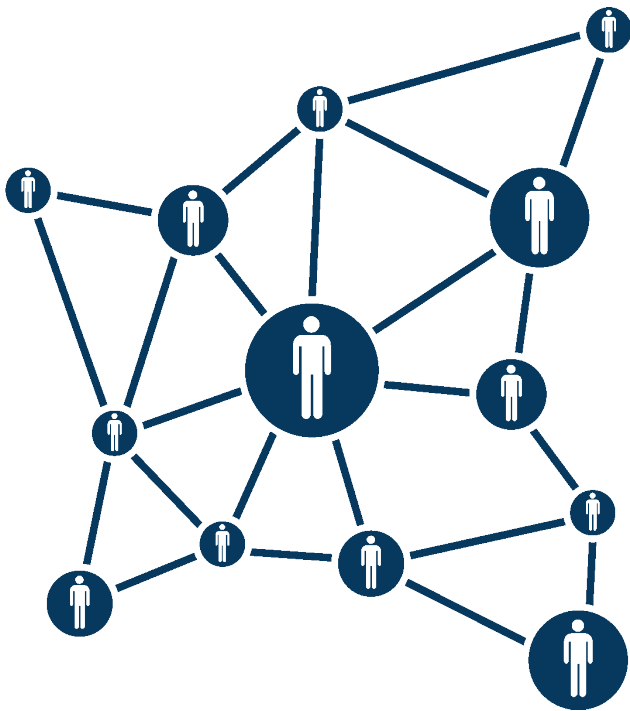
Money is an amplifying lever. The Greek mathematician Archimedes' assertion that force can be amplified with a simple tool serves as a handy metaphor when applied to money. From Medici to Carnegie and Morgan to Gates, each found that their force, or influence, was amplified by money, for better or worse. Their tool was a pool of capital; it was the lever that allowed them to exert influence. This tool has been used to exert influence over charitable donations, financial markets, and politics. These historical examples illustrate that money can be most effective when it is pooled and directed toward a singular goal.

Directing a pool of capital toward a singular goal is easy and frictionless when there is a single source of funds. However, when a pool of capital is created from multiple sources, especially sources that are unknown to each other, a trusted third party is needed. Finding and compensating a trusted third party often makes capital pool formation prohibitively expensive and by extension creates a financial system that is exclusive. Further, because capital pool administration is expensive, most capital pools are obligated to seek the highest return on



capital, thus maximizing profit. This obligation changed with the creation of cryptocurrencies. Cryptocurrencies and distributed ledgers can be used to remove the need for, and the cost of, capital pool administration. Specifically, cryptocurrencies can replace the need for an administrator to record the proof of ownership in a capital pool. In this way, cryptocurrencies allow for the mass customization of the financial system where capital pools can form with little or no cost and are free to be directed at multiple goals.

But removing one job of the administrator simply shifts the point of trust onto the manager of the capital pool. Owners of the capital pool must still rely on an administrator to verify that funds have been moved into the pool and that those funds are then used for the specified purpose. For example, in the hedge fund industry the job of the administrator is to receive funds from clients, place those funds into the capital pool (hedge fund) and finally record where those funds have been invested. This function comes with a high cost and as such creates a prohibitively high barrier to entry...until now.



The PAR System is a capital pool administration tool that will leverage the strengths of cryptocurrency to do the same job as an administrator at a fraction of the cost. The PAR System will use tools like the Interledger Protocol and Ripple to track and move money into and out of capital pools and provide real-time auditing.

BKCM LLC (my company), has made an investment in Tendermint and its Cosmos network. It is our intention to leverage this technology to build products on top of the PAR System. In addition, Nautiluscoin will be the native currency of this ecosystem; users of the PAR System will receive discounted rates when fees are paid in Nautiluscoin.

The following paper lays out our vision of the PAR System and how it will use cryptocurrency tools to connect the traditional and cryptocurrency financial systems. The connection to the traditional financial system will allow the PAR System to be used by virtually any capital pool from hedge funds to charitable organizations to social lending organizations. It is our mission to create a product that reduces friction and makes the financial system more inclusive. The PAR System is our lever, with which we intend to move the financial world forward.

PAR: Capital Pool Management Utilizing Public and Private Ledger Technology

ABSTRACT.

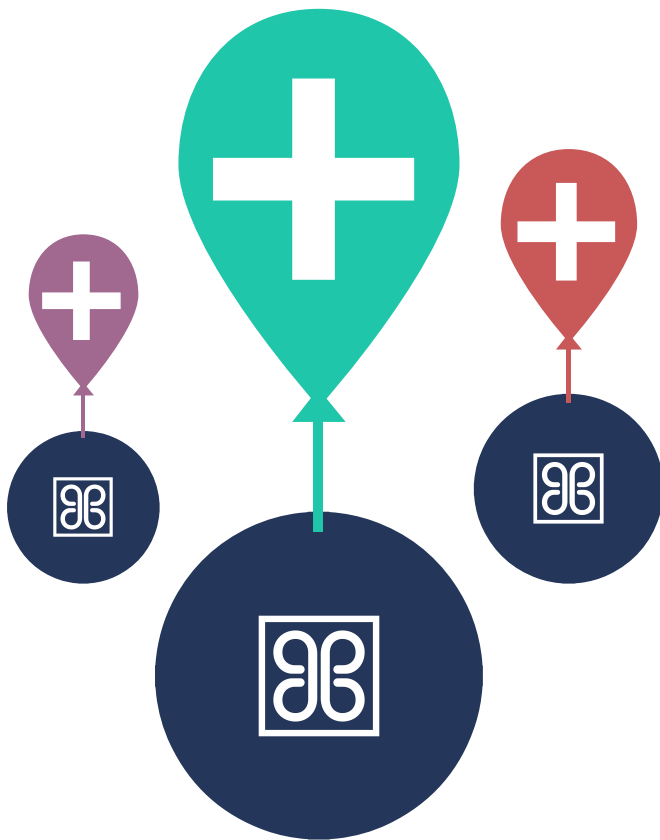
The purpose of this white paper is to put forward a plan for an infrastructure called PAR (Productive Asset Record System) that can support automated liquid investment in productive assets. We intend to use existing crypto-currency tools to create a bridge to the traditional financial system. Nautiluscoin (NAUT) will be the native currency of this ecosystem. The first step on the path is a platform which leverages both public and private ledgers to efficiently create and administer capital pools.

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• PAR - NAUT: A Crypto Bridge •



PAR is a tool designed to efficiently create, manage and administer capital pools by combining the strengths of both public and private ledgers into one system. PAR will enable greater capital formation due to reducing administration costs, increasing post-close liquidity, and lowering the barrier to entry for investing in funds. PAR leverages cryptocurrencies and distributed ledgers to provide decentralized escrow, capital flow into and out of the system, and a liquidity pool for ownership of funds. PAR also provides accounting focused on productive capital, similar

to BlackRock's Aladdin Platform. By allowing capital pool directors to create rule sets that govern capital flow, investment return allocation, and fee collection, the system provides flexibility and automation of capital flow.

Predetermined fees will be collected during capital pool creation, investment distribution, and return generation. An essential goal of this project is not only to create a crypto-bridge but also to link NAUT to a productive asset. This goal will require extensive work with regulators to determine the exact nature of digital currencies from a legal perspective. Doing so is worth the effort because successfully tying cryptocurrencies to productive assets will make them a more viable asset class for a wider range of investors.

Our plan is to seek approval for NAUT coins to be convertible into an equity stake in PAR, and those who convert their coins into PAR equity will be treated pari passu with other equity investors, including any who fund the development of PAR via investment rounds. A conversion from NAUT coins to PAR equity will likely be voluntary, and this will require a high level of KYC and due diligence.

NAUT will also be used as the native currency of PAR - the fee to use PAR can be paid in NAUT and the user will receive a discounted rate. Additionally, a portion of the fees generated by PAR will be used to buy NAUT in the open market.



We are working rigorously to perfect our plan and proposal. After reviewing the completed plan with our counsel, we will approach the appropriate regulatory authorities for approval. This will be the first time an effort created in the crypto space is brought to regulators to unpack the differences between cryptocurrencies and equity stakes. We are hopeful that regulators will be open to our proposal, but there is still significant work to do. Transparency will be maintained throughout this process, as it is our belief that this will help the regulators understand and shape the future of this space.

The goal of this effort is to determine how to impart real world value on cryptocurrencies. We are optimistic about the potential of this plan, but there is no assurance that regulators will approve our proposal or even be in a position to comment, as jurisdictional issues will impact regulatory clarity. Current holders of NAUT should be aware that they are not entitled to or being offered any portion of revenue until and if the plan is approved.

• CAPITAL POOL ADMINISTRATION •



A capital pool management tool will serve as an important platform for future products. Many additional use cases can be built on top of the PAR stack via Tendermint's Cosmos. We see the most promising use cases to include hedge fund administration, charitable donations and social lending. It should be noted that use of PAR is not limited to the initial use cases identified. As a tool for administering capital pools, the use cases are only limited by pool operators' imaginations.

PAR is a platform for accounting, auditing, automation, and administration of productive assets. One reason that platforms like PAR seem non-existent, despite the advantages a public ledger may offer in such an endeavor, is because there is currently no efficient way to bridge capital into these systems in a way that natively connects and leverages the benefits of a public ledger, while also providing acceptable privacy levels. Private ledgers are able to provide more functionality by assuming some level of trust and

real world dispute settlement mechanisms, as well as faster transaction and validation times. These characteristics are necessary and assumed in the construct of our financial markets, so any blockchains that wish to participate in these markets must also feature these qualities, among others.

Banks are not perfect, but they have proven to be quite resilient. The very idea of T+3 settlement, fractional reserve lending, intraday credit, the trading of assets that do not follow delivery versus payment (DVP) instructions sets, and the general structure of custody, sub-custody, and title convenience in the United States implies that there is trust in the financial system and the banks. Even when bank failures have occurred, very few people have lost money in the form of deposits. In fact, no one has ever lost a single penny of deposited money that fell within the limits of the FDIC or SIPC.

Without the aforementioned backing efforts, the success of all other goals of this project would be impossible. Our solution is to provide a trust layer, with the added functionality needed to create and track productive assets. This trust layer will be positioned as its own ledger that can produce audits and perform record keeping, while inflows and outflows will be through public chains. This allows net numbers to be easily compared to internally generated audits to ensure accuracy and reliability.



While we are suggesting that complementary currencies, social and micro lending, and voting take place on a connected public ledger, which may seem like a dramatic shift in direction, it is important to note three things. **First**, we plan to team up with the Cosmos team to build these applications. **Second**, the fees and interest charged on these loans will come back to the PAR network and be distributed to the owners of the capital pool tokens, with a portion being taken as a network fee for PAR holders. **Third**, it is still possible to create these products directly on PAR - it simply occurs to us that the general appetite for these projects lies more with public ledgers. Lending Club, Prosper, Kiva, or any other similar project could still use PAR for their bookkeeping and administration backbone, with or without accessing the public chains.

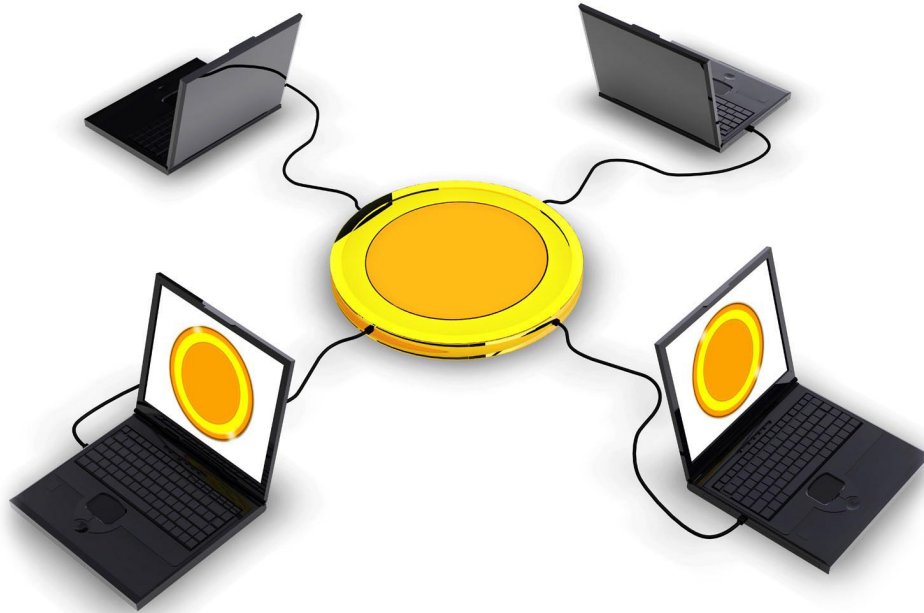
PAR Features

- PAR to create capital pool
- Mediate investment
- Control distribution of investable assets to manage
- Track repayment/return on investment
- Control profit-sharing strategies
- Return fee to PAR holders

Another Way To Look At It

- Raise capital
- Allocate ownership (coin)
- Make lending decisions (A)
- Disburse real money
- Collect repayment (A)
- Route repayment to investors

• HOW PAR WORKS •

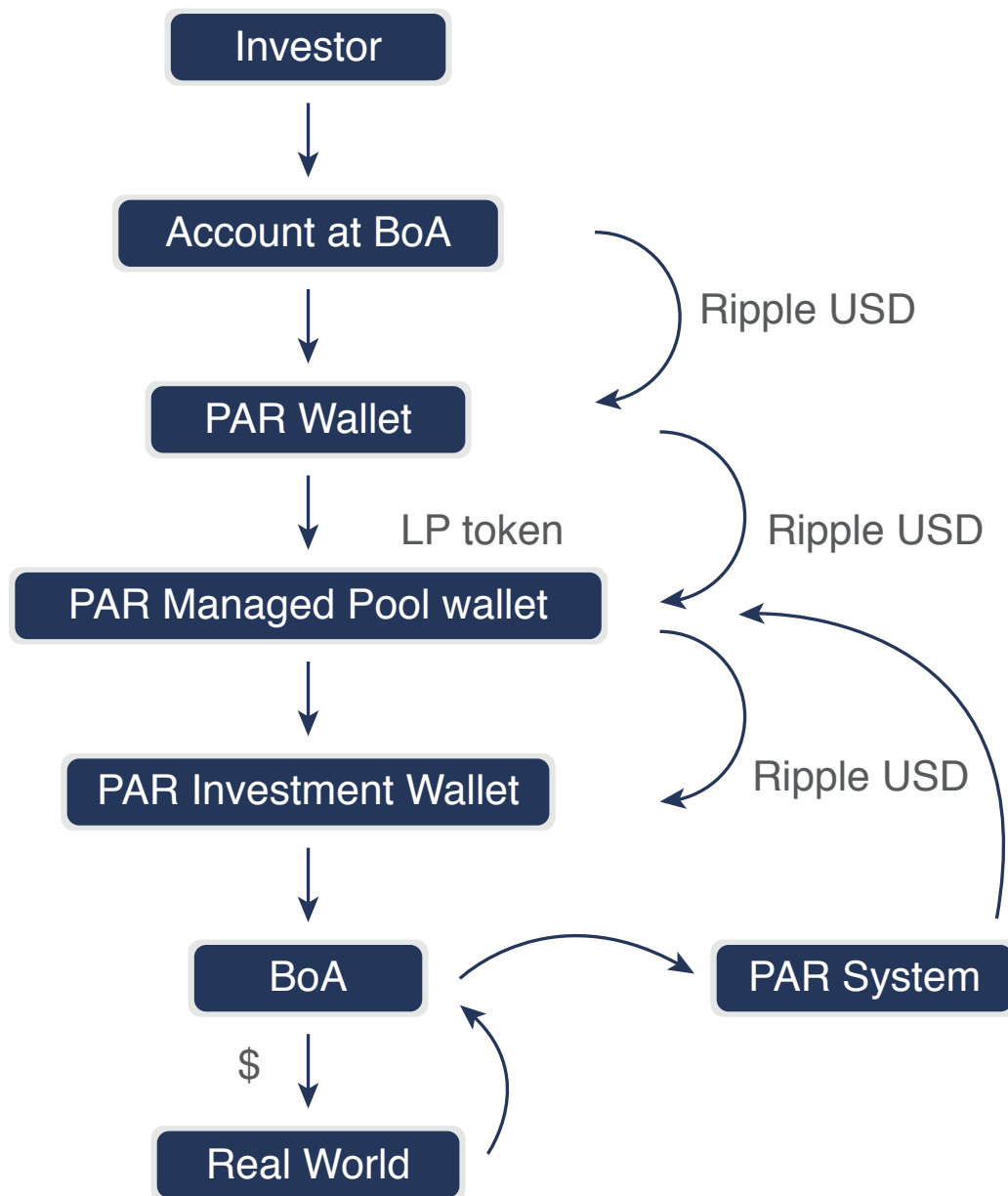


Capital

When a user wants to set up a new productive asset on the PAR platform, she first specifies investment parameters and a management rate (a combination of flat fee, percentage of capital, percentage of gross return and percentage of net return after preferred threshold). She then receives a GP (General Partner) token which allows the holder to control a new capital pool wallet. She also receives Investor tokens that she can distribute.

Investors can send US dollars into the system by sending money to a Ripple gateway, then transferring it into the system through Interledger for PUD (PAR US Dollars). Once an investor has PUD and an Investor token, they are able to transfer funds into the capital pool wallet if they agree to the wallet's terms.

When the GP thinks enough capital has been raised, she can close the investment channel. At this point she collects the flat and capital percentages of the fee, and the PAR master wallet takes a fee. The PUD in the capital pool wallet converts to a pool-specific, dollar-tracking currency (CPD), which the GP can withdraw through Interledger in order to carry out the authorized operations of the pool. Any Investor tokens that were used automatically convert into LP tokens, while unused Investor tokens simply disappear.



When the investment generates returns, the GP sends those returns into the system through Interledger. This is converted back into PUD and transferred to the capital pool wallet. The PAR system takes the gross cut out for the GP, takes a fee for the master wallet, and sends the rest of the cut to the GP. The rest of the returned funds are distributed to the holders of the LP tokens. Once the investment has returned the preferred threshold, the net cut starts going to the GP as well, less the fee for the PAR master wallet.



Opportunity Wallets



There are many additional applications of the system that can be added over time. One example of this is allowing entrepreneurs, borrowers and other capital seekers to create a

wallet along with a pitch requesting a specific amount of money to fund their endeavour in exchange for interest, equity, or some other arrangement. If a GP then chooses to fund an opportunity, she would lend CPD to the individual's wallet. The person who owns the wallet could then withdraw the money through Interledger and use it to fund their venture, eventually repaying the CPD using PUD when the time comes. While the first version of PAR will not support capital pools seeking funding in this way, this is still an exciting example of the potential of a system structured in this way.

Evaluator Wallets

Evaluator wallets would exist to give qualified individuals the ability to make recommendations for investments. Similar to the creation of a capital pool wallet, a user would create an evaluator wallet by sending NAUT to the master wallet. This would give the user control of a new wallet with the ability to issue an arbitrary amount of recommendation tokens. Fee structure for these wallets would be similar to the GP structure (flat, gross, net). Exchange rates

could be set by GPs between their wallet's CPD and the evaluator's recommendation tokens.

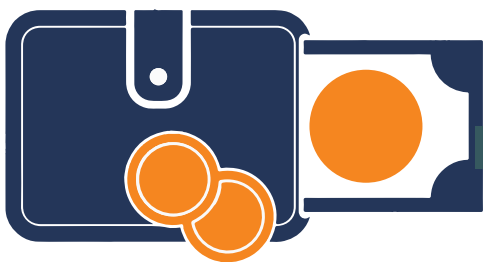
Evaluators would have the ability to send recommendation tokens to any opportunity wallet. If the opportunity and recommendations match criteria set by a GP, the capital pool would automatically fund that opportunity, and the non-flat terms of the evaluator would attach to the CPD debt to be paid when the debt is paid.

A Real World Example

Abacus Partners is a real estate investment company in New York, headed by Abby Abacus. Abby wants to invest \$100M in residential projects in Queens. Abby's friend Bertrand Brussels is interested in being part of the project, but is not an expert in the space. He trusts Abby and wants to invest \$200M.

Abby decides to create a partnership to execute the deal. She sends NAUT to the PAR master wallet and creates a new capital pool wallet which she calls Crash Course Capital. She talks to Bertrand about reasonable terms, and chooses to take one half of one percent of gross return, and 20% of net over a preferred threshold of 2% annual return.

Along with the General Partner token she gets, which controls the wallet and receives the revenue sharing payments, she receives Investor tokens. She sends 5 tokens to Bertrand so that he can structure his investment however he wants between various divisions and partners in his organization.



Bertrand sends one of the Investor tokens to his friend Clarice, who is a virtual currency investor. She has \$5M of Bitcoin at Bitstamp, which she sells for USD and sends to her PAR wallet via Interledger. She then funds the capital pool wallet using her token.

Bertrand has a Descendant's trust at Capital One Bank, so he creates a PAR wallet for the trust, sends it the token, and instructs Capital One to send \$20M from the trust to the wallet. Capital One wires the money to Bank of America, which issues USD debt on the Ripple network. This moves into the PAR system through Interledger, and from there is placed in the Descendants Trust wallet. Finally, Bertrand moves it to the capital pool wallet.

Bertrand sends a token to his friend Zach, who is also interested in the investment. After looking at the terms on the token, Zach decides that Abby wants too big a cut and does not invest.

Bertrand creates two PAR wallets, one for himself and one for a fund he has already raised. He sends \$120M from a personal investment account and \$60M from his fund into the PAR system, which issues PAR US Dollars (PUD) into his two wallets. He then sends it on to the capital pool wallet.

Abby negotiates an arrangement with Wells Fargo to hold \$100M in escrow pending distributions,

and the PAR System issues PUD on the network backed by that assurance. She sends the PUD to the capital pool wallet, bringing the wallet's total to \$300M. This is enough for her purposes, so she closes the pool using the GP token.

When the pool closes, the 300M PUD becomes a new currency, Crash Course Dollars (CCD). This allows her to track spending and gives her control over investment preferences for different pools. Abby can now send out the money to be invested in projects.

Abby negotiates a deal with a real estate law firm to pay them through the PAR system so that the bills can be easily coded as expenses. She buys a building in Astoria for \$180M, and after the law firm bills her for \$200,000, she has \$179.8M left in the capital pool wallet.

Abby decides that she wants to turn some condos into rentals, with the expectation that they will go up in value over the next ten years. She does not have detailed local knowledge of the condo market, so she goes looking for evaluators.

Eddie and Frank are two evaluators who have strong local knowledge of the Queens condo market. They find condos for sale, determine their value, and help sellers get set up to accept money through the PAR system.

Both Eddie and Frank have evaluator wallets, but they are set up differently. Eddie takes a \$10K fee for every recommendation of his that is used, plus he takes 6% of the net on the life of the deal. Frank takes 0.5% of gross up front and 2% of net.



Frank and Eddie issue recommendation tokens to deals based on what they expect the total gross income for each will be.

Abby decides to value Frank's tokens at \$1.05 and Eddie's at \$0.95, because she trusts Frank's judgment more. The system automatically discounts for their fees when matching deals, and finds \$43M of deals through Frank and \$35M through Eddie. The system matches the deals, sends the flat/gross payments to Frank and Eddie, and the bulk of the money to PAR wallets that represent the deals. The managers of those wallets pull the money out of the system however they prefer (most prefer bank wires, but one brave soul sells his condo for Bitcoin).

As the manager of the capital pool, Abby puts IOUs in the wallet representing the properties she has acquired to help with accounting. Should those assets ever become manageable over Interledger, the IOUs can be replaced with tokens

that are more tightly bound to the asset. She also has \$40M left in the pool.

Abby spends \$1M on various management expenses, among which are permits for expanding and renovating her large building in Astoria. These were hard permits to get, and many people thought getting them was unlikely, so some people now value the pool more highly. Bertrand wants to unload risk, so he sells off 15% of his personal stake in the pool to Georgia for a 10% profit.

At this point the fund is stable for a period of time. Abby has \$40M that can be used to deal with any issues that arise or to make additional investments. Ownership in the fund is liquid and pieces of it can be traded at will.

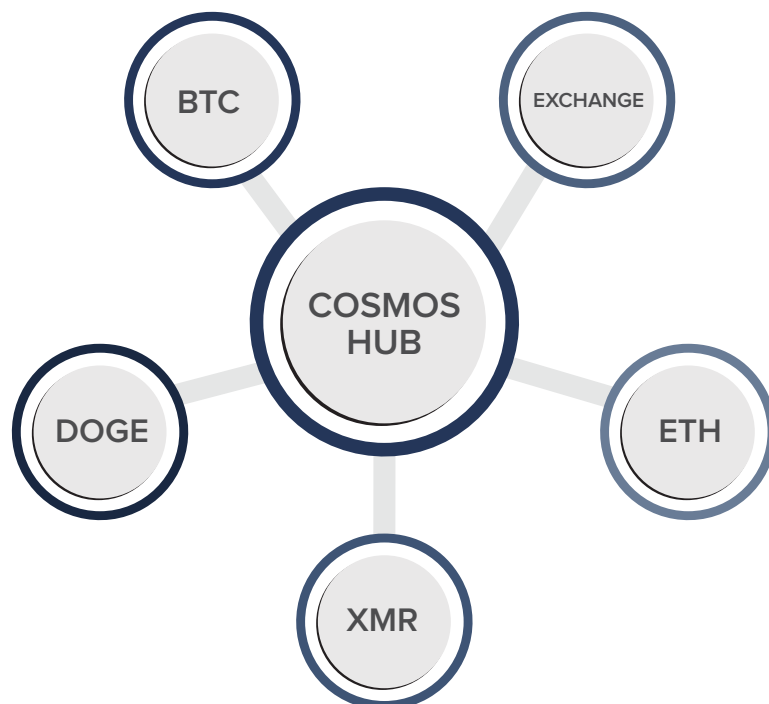
As cash comes in from the fund's investments, it is distributed to the owners, less Abby's cut and the system's fees. Eventually all assets are distributed or written off, and the fund is closed.

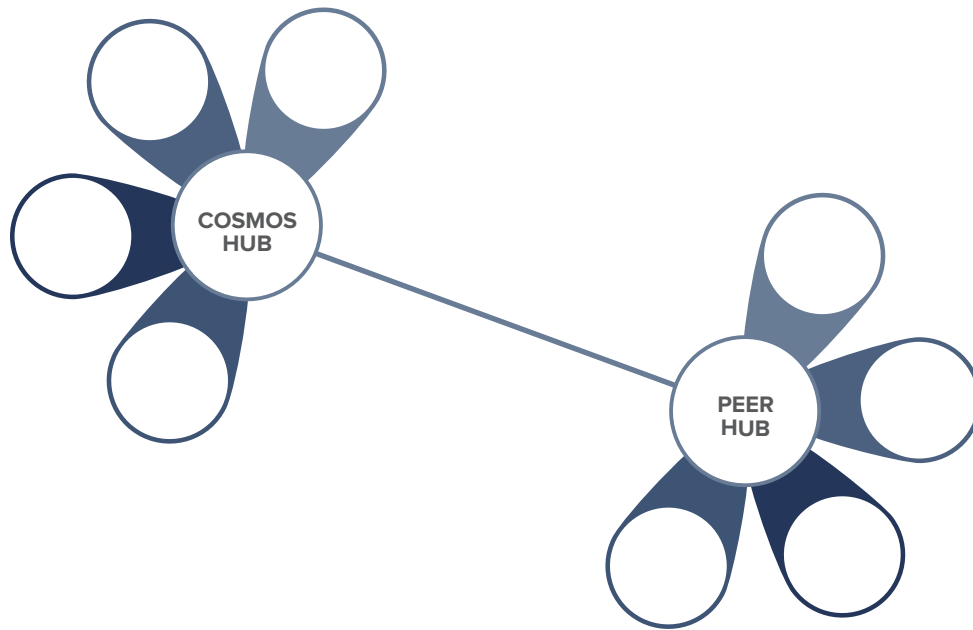
• WHY THE COSMOS NETWORK •



The Cosmos network will be used to build LP structures and complementary currency systems for PAR. Since it also allows for Interledger to be used as a complement to Cosmos, the network provides the essential bridge to the traditional financial system.

The hubs and zones of the Cosmos network communicate with each other via an inter-blockchain communication (IBC) protocol, a kind of virtual UDP or TCP for blockchains. Tokens can be transferred from one zone to another, securely and quickly, without the need for exchange liquidity between zones. Instead, all inter-zone token transfers go through the Cosmos Hub, which keeps track of the total amount of tokens held by each zone. The hub isolates each zone from the failure of other zones. Since anyone can connect a new zone to the Cosmos Hub, zones allow for future-compatibility with new blockchain innovations.

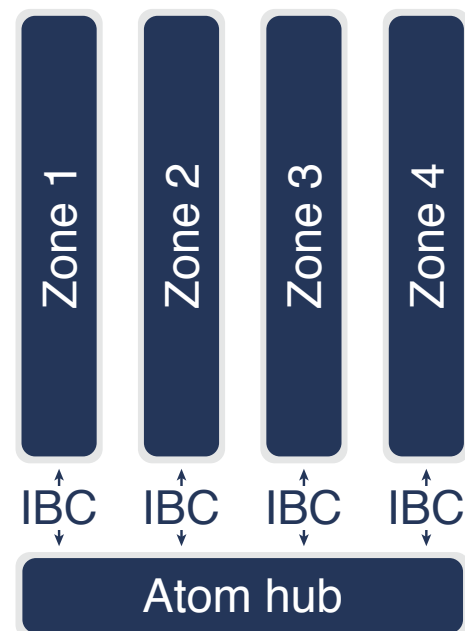




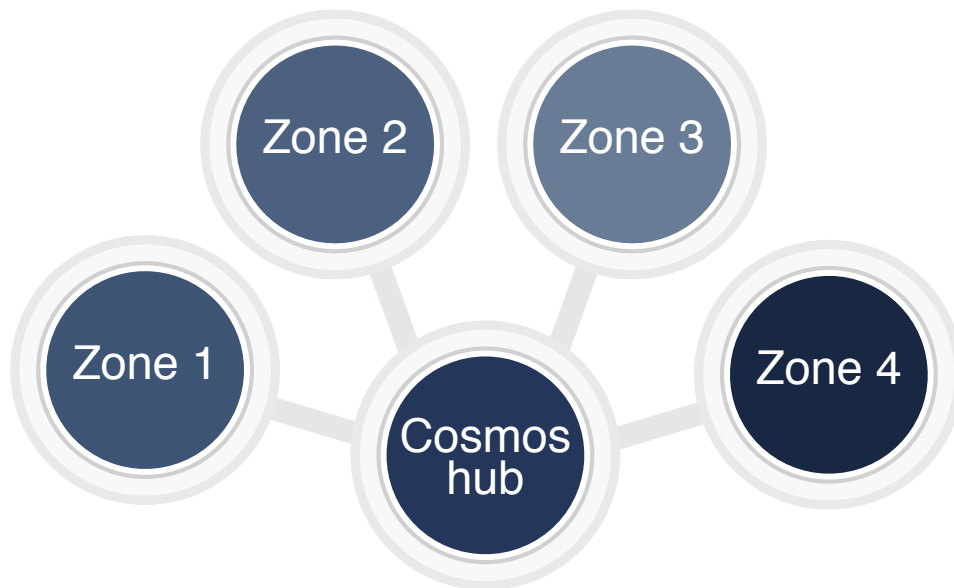
Cosmos is a network and framework for interoperability between blockchains. It consists of a web of "hubs" and "zones", where each "zone" is effectively an independent blockchain with an arbitrary cryptocurrency design and each "hub" is a multi-asset cryptocurrency that facilitates interoperability between some set of zones.

Hubs and zones are powered by the **Tendermint Proof-of-Stake (PoS) consensus algorithm**, using the **TMSP interface** to host applications written in any programming language. TMSP permits enormous flexibility in application design and enables the application to inherit the security features of a Tendermint-powered blockchain.

A Cosmos zone is an independent blockchain that exchanges IBC messages with the Hub. From the Hub's perspective, a zone is a multi-asset account that can send and receive tokens using IBC packets. Like a cryptocurrency account, a zone cannot transfer more tokens than it has, but it can receive tokens from others who have them.



Zones communicate with one another through a hub, primarily in the form of asymmetric transfer of some set of tokens from one zone to another. Effectively, a hub is a blockchain with many sidechains, but using PoS instead of PoW leads to a dramatic reduction in overhead without sacrificing security. The trick is that each zone acts as a light client for the hub, and the hub acts as a light client for all its zones. Tendermint makes this efficient with compact light client proofs that are secure as long as the validator set is known, which can be achieved by ensuring the light client synchronizes with validator set changes at least as often as they are permitted to occur.



Cosmos thus introduces a new kind of market dynamic that formalizes the power struggle between the various cryptocurrency offerings, demolishing the barriers to interoperability and enabling competition between hubs to contribute to the economic security of each hub itself - validators who misbehave will be abandoned for better behaving ones. The result is a heterogeneous network, adapting for each community and each locale according to its needs, and yet retaining a backbone of interoperability that keeps barriers to entry low while holding stewards of the system accountable and quality of service high.



Cosmos Performance Measures

Along with strong guarantees, Cosmos provides exceptional performance. In benchmarks of 64 nodes distributed across 7 datacenters on 5 continents, on commodity cloud instances, Tendermint consensus can process thousands of transactions per second, with commit latencies on the order of one or two seconds. Performance of well over a thousand transactions per second is maintained even in harsh adversarial conditions, with validators crashing or broadcasting maliciously crafted votes.



Cosmos Governance

Governance on Cosmos is different than other ledgers for several reasons. One is that the stakeholders are well defined, as is the prior social contract. Ether struggled with the fork because miners simply followed the money while Ether holders had no prior social contract or obligation to partake in governance, so they couldn't achieve a quorum. Cosmos is different. Instead of anonymous miners there are social contract bound validators and delegators who have stake, along with an obligation to partake in governance.



Comparison of the Interledger Protocol to the Cosmos Network

The Interledger Protocol (ILP) [14] is not strictly a scalability solution. It provides an ad hoc interoperation between different ledger systems through a loosely coupled bilateral relationship network. Like the Lightning Network, the purpose of ILP is to facilitate payments, but it specifically focuses on payments across disparate ledger types. It also extends the atomic transaction mechanism to include not only hash-locks, but also a quorum of notaries (called the Atomic Transport Protocol). The latter mechanism for enforcing atomicity in inter-ledger transactions is similar to Tendermint's light-client SPV mechanism, so an illustration of the distinction between ILP and Cosmos/IBC is warranted, and provided below.



1

The notaries of a connector in ILP do not support membership changes and do not allow for flexible weighting between notaries. On the other hand, IBC is designed specifically for blockchains where validators can have different weights and where membership can change over the course of the blockchain.

These weightings are positive integer voting power. Tendermint validators may have arbitrary non-integer voting power.

2

As in the Lightning Network, the receiver of payment in ILP must be online to send a confirmation back to the sender. In a token transfer over IBC, the validator-set of the receiver's blockchain is responsible for providing confirmation, not the receiving user.

In Cosmos, validators validate the transaction instead of the person receiving the transaction. In ILP, cryptographic messages are sent from the receiver of the transaction to the connector and this, in turn, releases the funds from escrow.

3

The most striking difference is that ILP's connectors are not responsible for keeping authoritative state about payments, whereas in Cosmos, the validators of the Cosmos Hub are the authority of the state of IBC token transfers as well as the authority of the amount of tokens held by each zone (but not the amount of tokens held by each account within a zone). This is the fundamental innovation that allows for secure asymmetric transfer of tokens from zone to zone; the analog to ILP's connector in Cosmos is a persistent and maximally secure blockchain ledger.

ILP has no specification about what they have at stake. Cosmos is more explicitly crypto-economic: the study of public distributed cryptographic ledgers as economic and game theoretical systems. Cosmos knows how many tokens are in each zone, but not the amount in each account within the zone. This keeps a level of anonymity for those within each zone. The network itself is also more scaleable, and the Cosmos Hub is the escrow solution.

According to ILP documentation, connectors do not keep transfer state information. All state information is kept at the ledger level and connectors merely react to and trigger ledger events. This doesn't necessarily mean that all connectors are stateless as they may keep track of their available liquidity or even maintain an internal ledger if they are transacting on behalf of third parties. ILP assumes connectors do not keep authoritative state data about transfers.



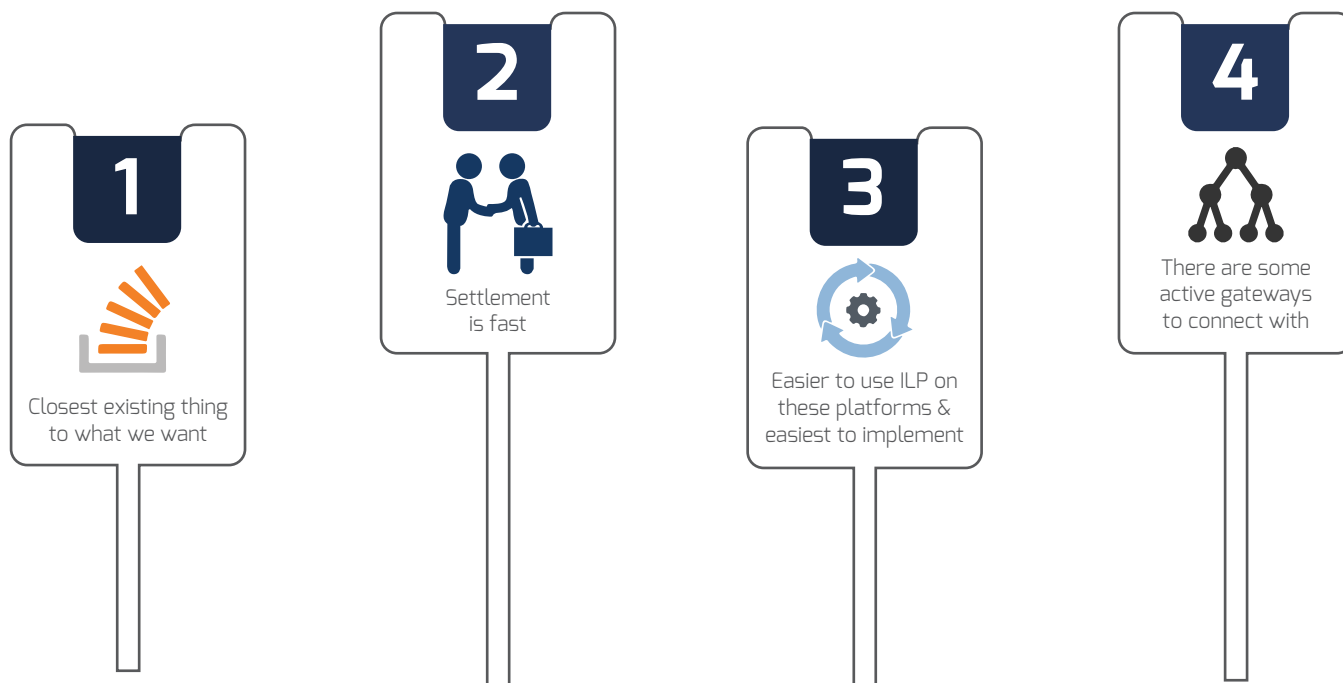
4

The inter-ledger payments in ILP need to be backed by an exchange order book as there is no asymmetric transfer of coins from one ledger to another. There is only the transfer of value or market equivalents.

Much like the Lightning Network, ILP is about bilateral payment channels. Cosmos is not. Without more specification, ILP assumes an order book system. Cosmos does not. The Cosmos hub functions as a central escrow. No order books are necessary to move value/tokens from one ledger to another. For inter-ledger payments, we anticipate starting with payments through the Cosmos hub. When the Lightning network or the ILP ecosystem are more developed they can be integrated with hash locked atomic transactions.

To be clear, Cosmos and Interledger are complementary rather than competing. Interledger will be very useful for creating Cosmos zones that interface with the traditional financial system. Interledger can also be used directly between blockchain zones. For this use-case, the Cosmos Hub may be a competitive option, as compared to other options for Interledger notary sets. The Cosmos Hub validators could also offer their services as an Interledger notary set.

• REASONS TO USE RIPPLE •



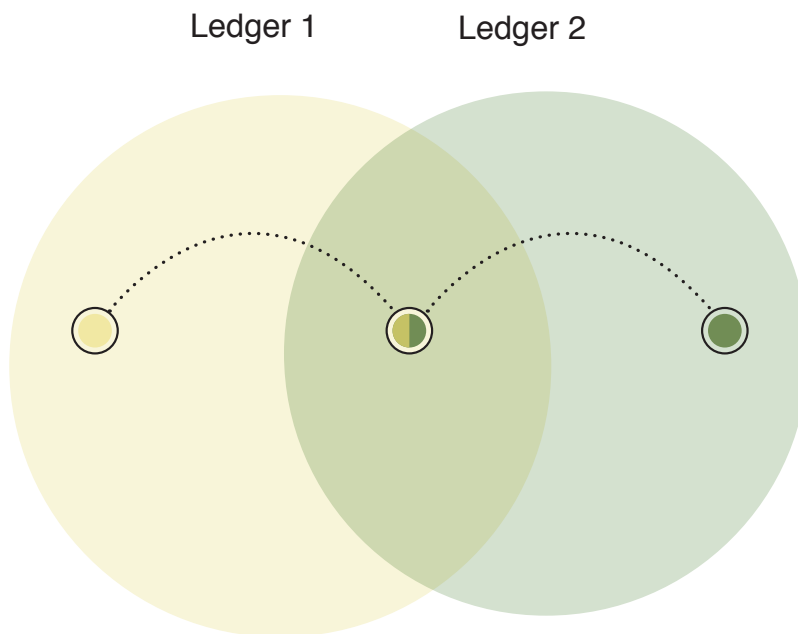


All electronic payments today need to be recorded on ledgers. If we do not, the asset might be transferred to different destinations at the same time. This is known as a double spend and can occur in both distributed ledgers and legacy ledgers. By drawing on much of the architecture of Ripple, Interledger uses advanced distributed ledger technology to prevent this from happening. Interledger aims to make the movement of money fast and frictionless, just like the internet did for information.

Interledger Protocol

Interledger is critical to the success of the PAR ecosystem as it allows for interoperability and interchangeability amongst legacy and distributed ledgers, as well as fiat and crypto-currencies. Traditionally, transferring money is fast and easy when both parties are on the same payment system or ledger, but difficult and cumbersome when people are not. This is due to a lack of standardization amongst existing payment networks.

Interledger (ILP) aims to act as a bridge between all payment ledgers. In the Interledger Protocol, transfer of assets between accounts on the same ledger are known as book transfers. A transfer of assets across ledgers requires two or more local book transfers. Some system must know the relationship between the two transfers and this system is called the connector. The same system may act as both a ledger and a connector. Interledger should be viewed as a protocol for interoperability between different ledgers, not as a ledger itself.





Connectors can be thought of as middlemen who are able to create accounts on both systems in order to connect the two ledgers. Connectors often charge high fees and have to be trusted to not steal your money. The ILP aims to standardize connections using ledger-provided escrow for the conditional release of funds only if a cryptographically signed receipt is received to communicate between ledgers. When the receiver sends a confirmation receipt, the funds or assets in escrow are unlocked. In ILP, payments go left to right, escrow goes right to left.

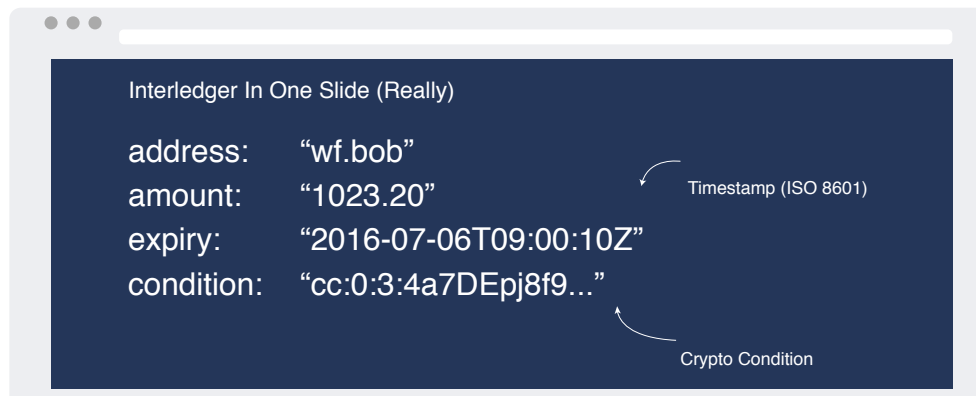
Instead of placing trust in the individuals who are sending money, connectors are able to rely on the immutability of the ledger. This is because the ledger allows the connector to verify that the money in question exists and has been committed to a specific transaction. A connector can trust the two ledgers on both

sides and verify the cryptographic signature and pass it on. This allows for value transfers to be done in a trustless way. The connectors are like relay nodes and the trust lies in the payment network not the connectors themselves.

Exchanges are essentially connectors that provide liquidity to facilitate transfers between different ledgers. The degree of automation in ILP is much better than alternatives due to standardized protocols that make routing payments much easier. This interoperability and interchangeability of both currencies and ledgers allows for a complementary/alternative currency system to be built on top of the system. As long as the ILP works as intended, the path payments take and how they are routed should be efficient even if multi-hopping is involved.

PAR will also provide ILP with increased volume and liquidity for payments. This will dramatically reduce the cost of payments while actually improving interoperability.

ILP is a good match for our use case of creating capital pools with PAR - including dividend, income and fee payments - because of the ledger interoperability and currency interchangeability that the protocol provides. ILP can also be used for an unlimited number of micropayments/microloans (as it scales to support that), which makes making payments a non-issue. ILP expresses payments in any generic way and can send data over standards like HTTP or torrents, which complements Cosmos well.



Steps for Interledger:

- ◆ Funds are committed from left to right
- ◆ Sender puts funds on hold
- ◆ Connector gets notification of funds on hold
- ◆ Connector puts funds on hold
- ◆ Recipient gets notification of funds on hold
- ◆ Recipient triggers payment by fulfilling the condition
- ◆ Transfers are executed right to left
- ◆ Recipient signs receipt
- ◆ Signature fulfills condition, ledger releases held funds
- ◆ Connector gets reimbursed by being notified that the funds have been released
- ◆ Connector passes on the recipient's signature
- ◆ Receipt releases funds from hold
- ◆ Sender gets non-repudiable proof of payment
- ◆ Transfers are committed right to left, executed left to right

Job of the Connectors

- ◆ Connectors convert currencies
- ◆ Liquidity curves determine exchange rates
- ◆ Connectors set rates per ledger pair
- ◆ Connectors advertise their routes

- ◆ Synthetic routes are created and added to the routing table
- ◆ Routing table grows quickly
- ◆ Connectors are payments routers.

Why Use Cryptocurrency For Issuance

A cryptocurrency is a medium of exchange similar to fiat currencies such as USD but designed for the purpose of exchanging digital information through a process made possible by certain principles of cryptography. Cryptography is used to secure the transactions and to control the creation of new coins.



A cryptocurrency for every PAR-administered capital pool provides the necessary data for macroprudential decision making. Money supply is determined by an algorithm so whoever comes on the ledger to issue their cryptocurrency can still control their monetary policy, including central banks and complementary currency providers. There are various ways that this can be accomplished:

- ◆ Pre-mining
- ◆ Allowing for increases in coin supply (mint new ones)
- ◆ Allocating certain coins
- ◆ Taking coins out of supply by “burning” them

According to a Deloitte report, “The Impact on Monetary Policy”, a central bank using a cryptocurrency could:



“The Central Bank could expand or contract the money supply just as it does today (for example, the function and structure of the U.S. Federal Reserve banks would be unchanged), through open market operations. The increase and decrease of cryptocurrency money in circulation could be governed by the Central Bank, according to demand, policy, and protocol (just as with fiat currency). In order to increase the supply of money, a Central Bank could transfer crypto-dollars - in real time - from its private key to different financial institutions' private keys. In

order to contract the money supply, a Central Bank could increase reserve requirements and financial institutions would transfer crypto-dollars to the Central Bank's private key, in a manner that would be functionally identical to how this process works today. Interest rates would be the same as they are for fiat paper money. Reserve account balances for banks would be maintained on the distributed ledger, offering additional benefits of instantaneous and free funds transfer. Over time, as the demand for paper currency reduces, so too would the bank's costs to manage it.”

Issuers can also make arbitrary design choices. Bearer tokens have a digital uniqueness in a way that ledger entries do not, which could be helpful from a balance sheet and risk management perspective in many use cases:

- ◆ True Delivery Versus Payment (DVP) in gold
- ◆ Cash management across a supply chain
- ◆ AML transaction tracing across banks

True DVP is very hard without an immediate bearer token cash settlement. There would have to be a central bank database of all money that everyone used, creating a significant risk due to a single point of failure that could affect the entire money supply. Other issues include internal fraud, balance sheet risk, and entities becoming “too big to fail.”

• COMPLEMENTARY CURRENCIES •

What Are Complementary Currencies



Complementary currencies run in parallel to national currencies and as such are often referred to as parallel currencies. The most recognizable complementary currencies are frequent-flyer miles which are used to purchase a particular product within a closed micro-economy. There is growing demand for localized complementary currencies as virtual services are creating new markets and micro-economies. These services have latent demand for a more appropriate value exchange and channels into the machine payable web (e.g. data securitization, sharing-economy, reputation management).

Complementary currencies (CCs) are one possible instrument that can be used to strengthen local communities and sectors. CCs run alongside a national currency and are often designed to address specific social, environmental, or political issues.

CCs can be set up for communities who don't have traditional access to financial capital or for adjusting region-specific spending patterns. They can encourage trade localization or the use of underutilized local resources. For sectoral currencies, the usage may not be regionally bound, but purely web-enabled (e.g. a book

exchange).

CCs can also be used to recognize an informal economy or even be set up as energy credits to reduce carbon emissions. They can insulate a community against exogenous shocks of the global monetary system or simply hedge against a poorly managed national currency. These currencies are not acceptable "legal tender" in countries that enforce legal tender laws to satisfy debts. Instead they function as a mutually agreed payment form for businesses or consumers who operate within the network. They are legal, as long as they meet certain region-specific requirements. Businesses that earn them are generally required to count them as taxable income. They are not allowed to look like national currency, and some operate with the backing of time or real value (gold, oil, services, etc...).

The History of Complementary Currencies



At present, there are hundreds of CCs in local and global circulation. These CCs vary greatly in purpose (region or sector based), mechanics (paper, digital, circulation incentives), convertibility (a closed or open system), and market cap. The United States, Germany and Australia have the highest amount by number.

Swiss WIR



One of the most successfully regarded CCs is the Swiss WIR, the currency of the WIR Bank in Switzerland. Launched in 1934 by a group of 16 businesspeople to adapt to currency shortages, it has grown to a massive group of over 60 thousand account holders. It currently does 6.7 billion SFr in transaction volume per annum and has 3.1 billion SFr

in a closed system of assets. It is primarily used in the agricultural sector but serves hospitality, construction, manufacturing, retail and professional services as well. It holds a currency code (CHW) with ISO 4217. Income from interest and credit clearing activities is around 38 million francs.

Ithaca Hour



The Ithaca Hour was started in 1991 in Ithaca, New York to promote local economic development. It is the United States' oldest and largest local currency. While non-local businesses are welcome to accept Hours, they are required to spend them on local goods and services. The Hour was born from a failed attempt to create the Ithaca LETS (Local Exchange Trading System), which was a special form of barter where points were traded for items.

One hour is valued at \$10 USD and is recommended to be used as payment for one hour of work, although the rate is negotiable. The currency, printed on paper bills, is not backed by the national currency and cannot be freely converted to USD. Several million dollars of value, among thousands of residents and over 500 businesses, have been traded since inception.

Critics claim that the Hour is facing reduced circulation velocity and suggest that the organizational problems with staffing, funding, circulation, and membership all stem from how expensive and hard it is to administer paper currencies.[1]

Chiemgauer



The Chiemgauer was started in 2003 in the German Chiem region in order to stimulate the local economy and to promote environmental, cultural, and educational sustainability. The success of the Chiemgauer may be explained by its departure from non-convertibility, as applied in closed systems like LETS or the Swiss WIR.

Chiemgauer are set at a fixed rate against the Euro, and Chiemgauer acquired by users flow into a fund that guarantees the credibility of the system. The Chiemgauer retains purchasing power within the region better than the Euro and stimulates transactions through demurrage.

Businesses can change the regional money back into Euro currency for a fee. To maintain a bill's validity, a "scrip" corresponding to 2% of the banknote value must be paid every three months. There is currently 740k Chiemgauer in circulation, with 6 million in annual transactions. The velocity of the Chiemgauer is 5.16 per year, over 3 times that of the Euro (1.66 per year). Chiemgauer is considered a first step in creating successful regional business cycles.

Q Coins



CCs can also include virtual currencies that may not initially have been set up to satisfy real world economic activity. QQ, a popular online instant messaging service in China, uses Q Coin as virtual money for users to purchase QQ related items for their avatar or blog. Q Coin is obtained either by purchase or for using the mobile

phone service. The coins became so widespread that they gradually became accepted by a wide variety of online retailers and gaming sites in exchange for real-world merchandise.

Due to Chinese currency volatility, some investors use Q Coin to stabilize their assets in the same way they use Bitcoin to dodge capital controls. This somewhat parallel currency raised the concern of replacing and/or inflating real currency in domestic transactions, causing China's central bank to begin restricting its use.

• THE ECONOMICS OF COMPLEMENTARY CURRENCIES •

Many complementary currencies will include negative interest rates or demurrage fees to stimulate participation. Speculation and gambling with CCs is deterred by intentional design, as these currencies can purposefully restrict regional spread, time of validity, or use sector. Some even require participation membership or points of acceptance.

Existing complementary currencies are unfortunately largely regarded as ineffective, with the cause of failure usually attributed to maintenance costs. Fraud, fake bills, and bad debts require constant monitoring to ensure a CC system is not compromised. This constant monitoring has a high administrative cost that leaves CCs vulnerable if they lack a stable self-financing model or external support. Additionally, members are usually inadequately incentivized to carry the burden of high transaction costs, especially at the inception of a CC system.

The Importance of Complementary Currency Systems



“Any non-biological system without variation is accumulating silent risk.”
Nassim Taleb

There are many additive and preventative benefits to setting up working CC systems. CCs are primarily deployed to meet the needs of communities that a national currency cannot, and they are often created either with a financial inclusion agenda to promote local economic development or when the predominant currency system is not working – deflating or being managed to stagflation.

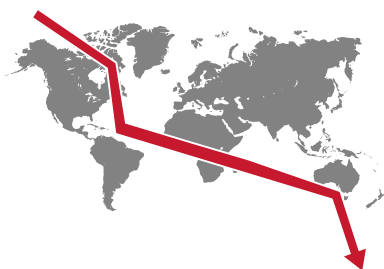
Localization Economics

Globalization arguably homogenizes consumer preferences. Local currencies can encourage local sourcing of goods, stimulate local demand and increase employment. Many communities have unused capacity to produce goods that do not require the complexity of a global supply chain. Globalization has arguably led to a prematurely optimized supply chain.



With a CC, communities are given more flexibility to stimulate inter-regional activity.[3] Monetary measures backed by the national interest to fuel GDP growth or to protect capital flight can arbitrarily add local economic rigidities that may harm communities and CCs can help guard against this threat.

Antifragility



Eighty-seven countries have experienced currency crashes in the past 20 years. Not only do CCs promote financial inclusion and community growth, they provide a lifeboat for groups when national currencies are volatile due to domestic fragility (e.g. a centralized banking system with bad housing market debt) or overexposure to exogenous shocks thereby making the currency unable to fulfill liquidity and fungible duties. When a centralized banking system fails, many pockets of society need a mechanism for economic resilience and would greatly benefit from more flexible and trustworthy systems of value transaction.

Cosmos & Complementary Currencies



A Cosmos zone has its validator set, and it can issue new currencies. On Cosmos, anyone can create new token types at an affordable cost. When a new token type is created in Cosmos, it's associated with a new zone. You can have a single validator do it, but then it is less secure. Cosmos could construct other structures to permission issuance, instead of merely $2/3$ by voting power. It doesn't have to come from a zone. Cosmos will have a name registry which will allow the PAR system to reserve the name "PAR" for its economic zone and the same for any other token that is created. Tokens could have inflation restrictions, like how much can be issued over time. You can also move tokens to/from other zones, as long as the zones accept them.

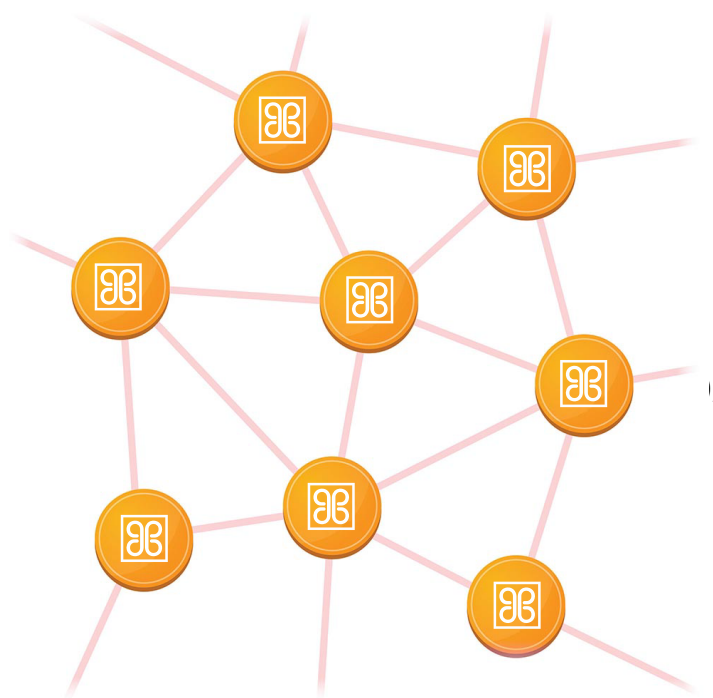
Conclusion

PAR will leverage existing cryptocurrency tools to create a capital pool administration system. The PAR System will allow virtually anyone to form a capital pool without the traditional expense of a non-crypto administrator. In this way, the PAR System is a step toward a more inclusive financial system.

PAR will also employ the power of the Cosmos network to create economic zones powered by their own complementary currency. In essence, each capital pool on the PAR System will be its own micro-economy with a native currency residing on an independent and interconnected blockchain. The data set produced within each economic zone will allow for automated real-time auditing and administration.

PAR is not strictly a “crypto project.” Today, forming an investment pool - be it a hedge fund, family office, or even a simple LLC for a real estate investment - can be extremely expensive and often cost prohibitive for smaller groups of funds.

Additionally, even for small to medium funds, administration costs can end up being a significant cost. PAR will slash the administrative costs of operating a capital pool. Not only is this a cost savings for existing funds but also it will allow smaller funds to be formed that previously were priced out of the financial system. PAR is a product that doesn't just save time and costs for existing funds, but encourages new capital formation and creates more economic activity. PAR will enable a significant increase in investment in the cryptocurrency space - making it much easier for coins and other crypto projects to get funding.



What's more, PAR also enables capital formation for non-crypto investment. Eventually capital pools could be formed to enable investing in any number of products and asset classes. As some point in the future, one could imagine a scenario where capital pool tokens on the PAR network become fungible. As the PAR System develops it could be possible to trade an investment in multifamily residential property in Queens directly into an investment fund focused on home health care. Imagine end users having access to a full slate of hedge funds and investment vehicles - all available on a comprehensive and robust peer-to-peer investment platform.

The PAR System is a step forward and uses existing cryptocurrency tools to build a bridge to the traditional financial system. Our goal for PAR is to be a bridge that opens a new pathway toward a more inclusive financial system.

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Appendix

Tendermint Definitions

Validator: Validators are full nodes of an Cosmos zone that have the responsibility of committing blocks in that zone. The Cosmos Hub will start with 100 validator spots. Due to the limited number of validator spots, not everyone who has atoms can be a validator. Instead, everyone else can bond atoms and delegate their consensus voting power to any of the 100 validators. Before Genesis, the Cosmos Crowdfund funders will play the Delegation Game to determine the top 100 bonded delegates who will become the genesis validators.

Delegator: An atom holder who put their atoms at stake by delegating its validating power and voting power to a validator. They are still responsible for voting on proposals during the vesting period, but if they don't vote they will be penalized, but they will inherit the vote of the delegated validator.

Cosmos Hub: A Cosmos hub is itself a blockchain, or zone, that connects to many other zones. The hub facilitates token movement between zones. The Cosmos Hub is the first hub, and the first zone. It is also written as "Adam". There may be more hubs in the future.

<http://www.coindesk.com/the-theory-of-a-blockchain-circular-economy-and-the-future-of-work/>

Complementary Currencies Extra Resources

Quora: Working Examples of CCs

Complementary Currencies: A Beginner's Guide

Bernard Lietaer

<http://complementarycurrency.org/cc-research-group-shared-timeline-project/>

https://en.wikipedia.org/wiki/Complementary_currency

<https://github.com/cosmos/cosmos/blob/master/whitepaper.md>

<https://interledger.org/>

<https://interledger.org/rfcs/0001-interledger-architecture/>

<https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/kpmg-blockchain-consensus-mechanism.pdf>

<https://home.kpmg.com/content/dam/kpmg/pdf/2016/06/appendix3-kpmg-blockchain-paper.pdf>



History of Modern Era of Complementary Currencies

1931

The Wara Currency System is launched in Bavaria

1934

The WIR Bank formerly the Swiss Economic Circle is founded.

1970

The Constant is launched based on a stable basket of currencies

1986

Ithaca LETS is started

1990

The LETS system spreads through the Web to make it global.

1992

Saltspring Island Dollars launched in Vancouver

1994

The Community Currencies in the Global South Website is launched

1996

The Calgary Dollar

1998

The Gogo Stable Currency concept is launched.

1999

Launch of the Toronto Dollar

2003

Launch of the Community Exchange System (CES). Cheimgauer CC introduced in Germany.

2006

Launch of Granja CC in Portugal. Berkshares also released.

2009

The Brixton Pound is launched

2012

The Bristol Pound

1932

The Worgl Currency System is Launched in Austria

1936

The Alberta Prosperity Certificate is launched by the Social Credit Party

1982

The Local Exchange Trading System (LETS) system software is released to regulates the exchange of goods and services between the members of the cooperative.

1989

DELI Dollars is launched

1991

The HOURS system is launched.

1993

The Tianguis Tlaloc CC System was launched in Mexico City

1995

The Red Global de Trueque is launched in Buenos Aires, Argentina. Fureai kippu introduced in Japan.

1997

Launch of the Doole SEC, Dakar, Senegal

1998

Asian Monetary Crisis Plans to launch the first CC System in SE Asia underway.

2000

Starting of Banco Palmas

2004

Launch of first CC system in Indonesia. This fully rupiah backed currency was launched in Java.

2008

The arrival of Bitcoin.

2010

The EcoPesa is introduced in Kenya

2015

The Exeter Pound. Tencent releases QQ coin.

PAR

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www.par.io